

FRIDAY, MAY 4, 1883.

THE PROPOSED MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE IN CANADA.

THE British association has not yet ventured to hold its meetings in any part of the empire beyond the limits of the British Islands. It has, however, so far crossed the sea as several times to hold meetings in Ireland; and its sister-association of France has set it an example by holding a meeting in Algeria. The idea of such extension of its geographical range is not altogether new. Projects of an international meeting have at various times been discussed, both in Britain and the United States; and it is understood that the present governor-general of Canada, who has shown much interest in the scientific progress of the new dominion, has had correspondence with leading men of science in England, with the view of either bringing the association to Canada, or securing a representative delegation to meet with the recently established Royal society of Canada.

The project of a visit to Canada only assumed definite form at the meeting last summer in Southampton. A motion was proposed, we believe by Capt. Bedford Pym, in the general committee, that the association should meet in Canada in 1883. This was lost on a division; but it was understood by the promoters of the scheme that the unfavorable result was in part due to the fact that they were unable to produce a definite invitation from any Canadian city. After the decision to meet in Southport in 1883, they therefore felt at liberty to propose that the meeting of 1884 should be held in the city of Montreal; and this was carried. Unfortunately, however, there was no official communication of this resolution till after the close of the meeting of the American association in Montreal: otherwise some steps might have been taken toward a combined gathering in 1884.

As soon as the resolution of the association was definitely known in Montreal, a movement was made to respond in a fitting manner. After a preliminary meeting called by the

president of the board of trade, and at which there were representatives of the McGill university and of the Natural history society of Montreal, the mayor was requested to call a public meeting, which was large, influential, and enthusiastic, and which passed resolutions pledging the city to do all in its power to make the meeting successful; appointing, at the same time, a large committee of leading citizens to carry these resolutions into effect.

In so far as accommodations for the meeting is concerned, and funds for its expenses, there can be no doubt that Montreal can entertain the association as well as any of the British cities in which it ordinarily meets; and its geographical position and facilities for access, and for communication with all parts of Canada, the northern states, and the west, present many attractions; while there is reason to hope that a meeting of the British association in Montreal would be attended not only by all interested in science in Canada, but by large numbers of the scientific workers of the United States. The experience acquired last year in entertaining the American association will also afford very valuable guidance. It was felt, however, that the real difficulty lay in the transportation across the ocean of so large a body as the British association, or even of that scientific nucleus of it which constitutes its essential part. The matter was therefore brought under the notice of the dominion government with the view of securing aid toward the passage across the Atlantic; and it is understood that a grant will be made sufficiently large to insure free passages to the officers of the society, and some of its more important members, who will also be the guests of the city, and reduced rates in favor of all the members who may be able to attend. Letters and printed circulars, giving information as to these points, have been sent to Sir Alexander Galt, the high commissioner of the dominion in London, and to Professor Bonney, the secretary of the association. From one of these, signed by the chairman of the local committee, and by Dr. Hunt, as chairman of the committee of invitation, the following extracts are taken:—

"The city of Montreal, which has a population of about 150,000 souls, has twice entertained the American association for the advancement of science, — for the second time, in August, 1882, when an attendance of more than nine hundred members and associates was registered, — and the association, with its nine sections, found ample accommodation in the buildings of McGill university. . . . We have assurance that the government of the Dominion of Canada will make a liberal grant of money to defray the expenses of members of the British association in crossing the ocean, and that the various railroad and steamboat lines in Canada and in the United States will offer most liberal arrangements to our guests. The Grand Trunk railway will arrange for an excursion of members of the association to the Great Lakes and Chicago; while the Canadian Pacific railroad will give an excursion to the provinces of the north-west, as far as the Rocky Mountains. The city of Montreal, from its climate, its geographical position, and its ways of communication, offers many attractions alike to the traveller and the student. The large and important collections of the geological survey of Canada, gathered during the past forty years, are in the museum at Ottawa; and these, together with extensive collections contained in the museum of the Natural history society of Montreal, and in that of McGill university, furnish ample materials for the study of the natural history of Canada. . . .

"Members of the British association, in coming to Canada, may be assured of a most cordial welcome and generous hospitality, not only from the citizens of Montreal, where every facility will be furnished for their meeting, but from the people throughout the country. It is hoped by the invitation committee that these assurances, and the above statement of the advantages and facilities offered them, may secure a large attendance of the members of the British association at Montreal in 1884."

It is well known that considerable opposition has existed in England to the project of meeting in Montreal; and it is natural that many of the life-members and associates who cannot visit Canada should view it with disfavor: but it is believed that the leading members of the association are of a different opinion, and that the hearty action of the city of Montreal and the dominion government will do much to disarm such opposition as may manifest itself next summer at Southport, where the final decision must be made.

It is to be observed, that in the present year the meeting of the American association, at Minneapolis, is early (Aug. 17); while that of the British association, at Southport, which is, besides, in the immediate vicinity of Liverpool, is unusually late (Sept. 19). This will allow members of the American association to attend both meetings; and it is stated that the retiring president of the American association, and possibly others of its members, may

avail themselves of this privilege. This may possibly permit arrangements to be made which might substantially unite the meetings of the two associations in 1884, and so prepare for an international meeting in the future. If the meeting of the American association for 1884 can be fixed for some north-eastern city, sufficiently near to Montreal, and can be timed so as to occur a week before or after that of the British association, there can be no doubt that a great number of the members of the latter body would take advantage of the opportunity to enjoy the companionship of their American *confrères*; while, on the other hand, many of these would gladly spend a few days at the meeting of the British association. In this way it would seem that a greater benefit to science might result than even from an international meeting. There would be time for the complete transaction of the business of both associations. Neither would suffer, either pecuniarily or in the value of its proceedings; and there would be the best possible opportunity for interchange of ideas between the scientific men of the United States, Great Britain, and Canada. Nor is it unlikely that some scientific workers from the continent of Europe and elsewhere may be attracted by a combination so unusual. It may thus be hoped that the proposed meeting of the British association in Canada may not only be one of the most successful that this mother of associations has held, but may inaugurate an epoch of renewed activity and progress in the widely-spread scientific work of the two great associations of the English-speaking race.

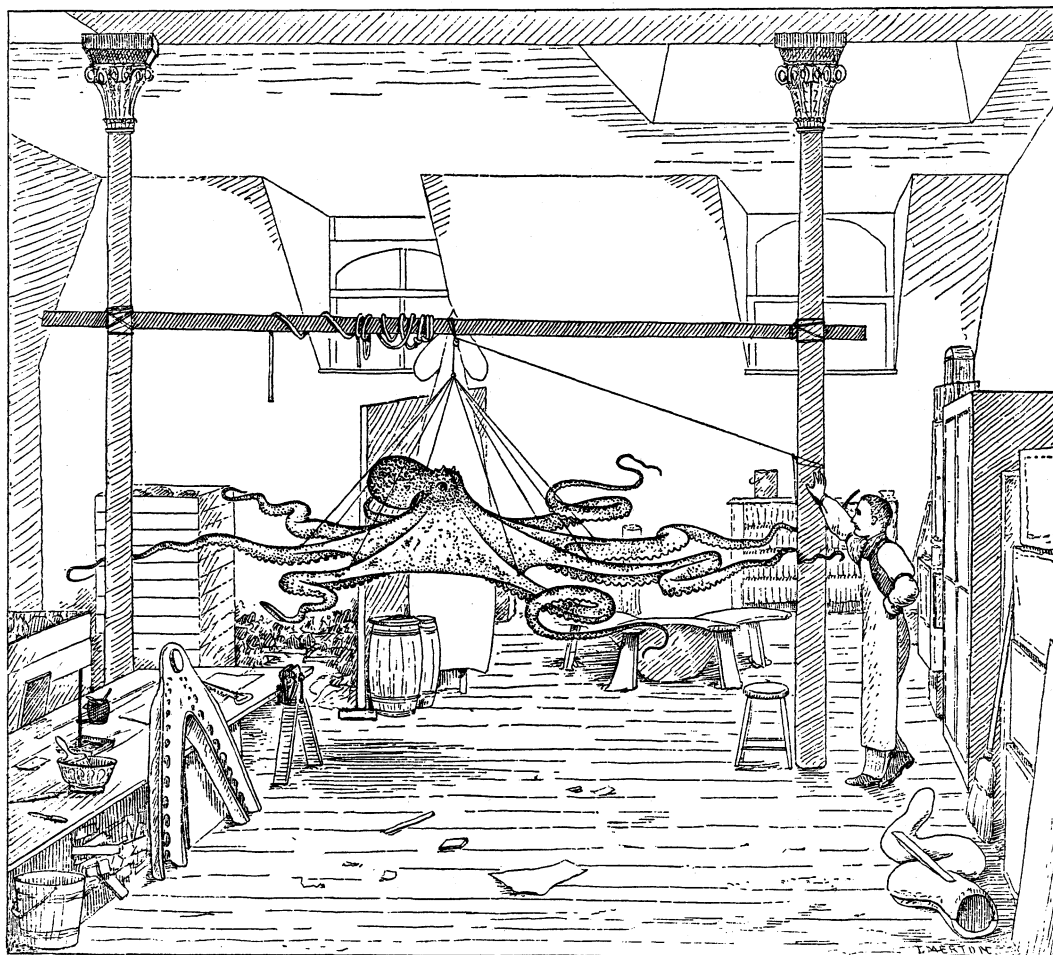
MODEL OF THE GIANT OCTOPUS OF THE WEST COAST OF AMERICA.

WHILE working on the models of the large Newfoundland squid (*Architeuthis princeps*) for the Yale and Harvard museums, it was proposed that I should also model the large Octopus of the west coast of America. Nothing was done upon it, however, until the past winter, while preparations were making by the U. S. fish-commission for the International fishery exhibition in London. For this exhibition, Mr. William Palmer, one of the modelers of the National museum in Washington,

was sent to New Haven to make a copy of the *Architeuthis* model; and, while this was in progress, plans for the Octopus were often discussed, and finally arrangements were made for him to remain in New Haven, to assist in making an Octopus model and a paper cast for the fishery exhibition.

As neither of us had seen the animal alive,

The original description of *Octopus punctatus* by Gabb, in the proceedings of the California academy of sciences for 1862, is from a small specimen preserved in alcohol, and so was of little use; and there appears to have been no good description published since, though there have been numerous notices of the capture of specimens of large size.



MODEL OF THE GIANT OCTOPUS HANGING IN THE WORKSHOP OF THE YALE MUSEUM.

nor could make a trip to California for the purpose, the model had to be copied chiefly from specimens preserved in alcohol, and restored according to the best information we could get as to its appearance when living. The largest specimens we could get were badly shrunken by the alcohol; and one of moderate size, with arms about three feet long, was selected; and from this most of the details of the model were enlarged four times.

On all anatomical points we depended chiefly on Professor Verrill's knowledge of the cephalopods. In the color, size, and position of the body, we were aided by descriptions and sketches by Messrs. W. H. Dall and A. Agassiz, who had seen it alive. I was also guided by my knowledge of *Octopus Bairdii*, the small species of the east coast, which I had several times seen alive.

The position of the middle part of the body

is that often taken by *Octopus Bairdii* when resting on the bottom after swimming, with the head raised, and the body supported on the thickest part of the arms. The ends of the arms are curved irregularly, as they might be in an animal just starting to crawl.

The highest point of the body is twenty-two inches above the lowest suckers. The arms spread over a circle eighteen feet in diameter, and the connecting membrane between the lateral arms extends three feet from the mouth. The longest arms, those of the second pair, are made as long as the largest measurements from life (sixteen feet); and the shortest, the fourth pair, thirteen feet. The third arm on the right side is shorter than the others, and hectocotylized in the male, and is so made in the model. All the arms are four inches in diameter at the thickest part. The body is made proportionally smaller than in small specimens. The warts on the head are copied from one of the largest specimens examined, the others showing only two pairs over the eyes. The membranes between the arms have been made much as they are in alcohol, but somewhat wider and more distinct along the sides of the arms. The largest suckers are two and a quarter inches in diameter, and decrease in size from the thickest part of the arm toward the tip, and toward the mouth.

For convenience in making and moving the model, the arms are made removable at a distance of three feet from the mouth, just beyond the edge of the widest membrane.

The upper side of the middle part of the model, including the head and body, was modelled in clay, and a mould made from it in plaster. This was then turned over, and the mouth and under sides of the bases of the arms modelled in it. The arms are so much alike that it was only necessary to model the bases of two of them, — one right and one left; and from these a plaster mould was taken in which the casts of the bases of all the arms were made. This mould stands against the table at the left in the engraving. The ends of the arms were modelled in a similar way, the back being first finished, and a plaster mould made, which was turned over, and the under side modelled upon it. For modelling the tops of the suckers, a set of stamps was made. A set of suckers of the desired sizes was modelled in clay on a turntable, and plaster casts made of the tops of them, and these used to stamp the tops of the rest of the suckers, which were trimmed round with a knife, and attached to the arm with soft clay, after which, the narrow membranes connect-

ing the larger suckers were modelled between them.

When the moulds were dry, the paper casts were made in them by methods which had been used by Mr. Palmer for models of large fishes and cetacea. The moulds having been greased, paper soaked with paste was laid in it, and pressed and rubbed with the hands until it fitted close to the surface of the mould, and the edges of the pieces of paper adhered together. When the first layer of paper was nearly dry, another was pasted over it; and, if the strength of the model required it, other layers were added. The thin membranes between the arms were strengthened by wire netting between the two layers of paper, the meshes being filled with whiting mixed with glue. On the surfaces of the suckers, paper pulp was put in the mould before the paper was pasted in.

After drying several days, the casts were taken from the moulds, the edges trimmed, and the pieces fastened together with glue. The broken places in the casts were mended with paper pulp, the joints covered over with the same material, and, when dry, the surface was smoothed with sandpaper, and varnished with shellac. The siphon was made separately, and afterward attached to the body. The mouth was made of plaster, showing the jaws closed. The eyes are of glass, like ordinary birds'-eyes, painted and silvered according to the best evidence we could get as to their color.

The color of *Octopus punctatus* seems to differ greatly, according to its moods and surroundings. It is commonly described as light orange or yellow with reddish-brown spots. At other times it appears to be bright orange and crimson, with dark-brown blotches on the back. The model was first painted light gray, on which the other colors were thrown from a brush in fine spots. The orange spots are scattered over the whole surface, and more thickly in patches along the back and sides of the arms. Crimson spots are distributed in the same way; and over both, dark-brown spots are thinly scattered. The faces of the suckers are yellowish white without spots.

The model weighs about seventy pounds, and is stiff and strong enough for ordinary handling, and only liable to be broken by a fall or sudden blow. It is intended to be hung in a horizontal position, as in the engraving, but high enough for the under side to be seen, as well as the upper. It hangs by eight wires attached to rings near the joints in the arms, and connected together above so that it can be hung from a single hook.

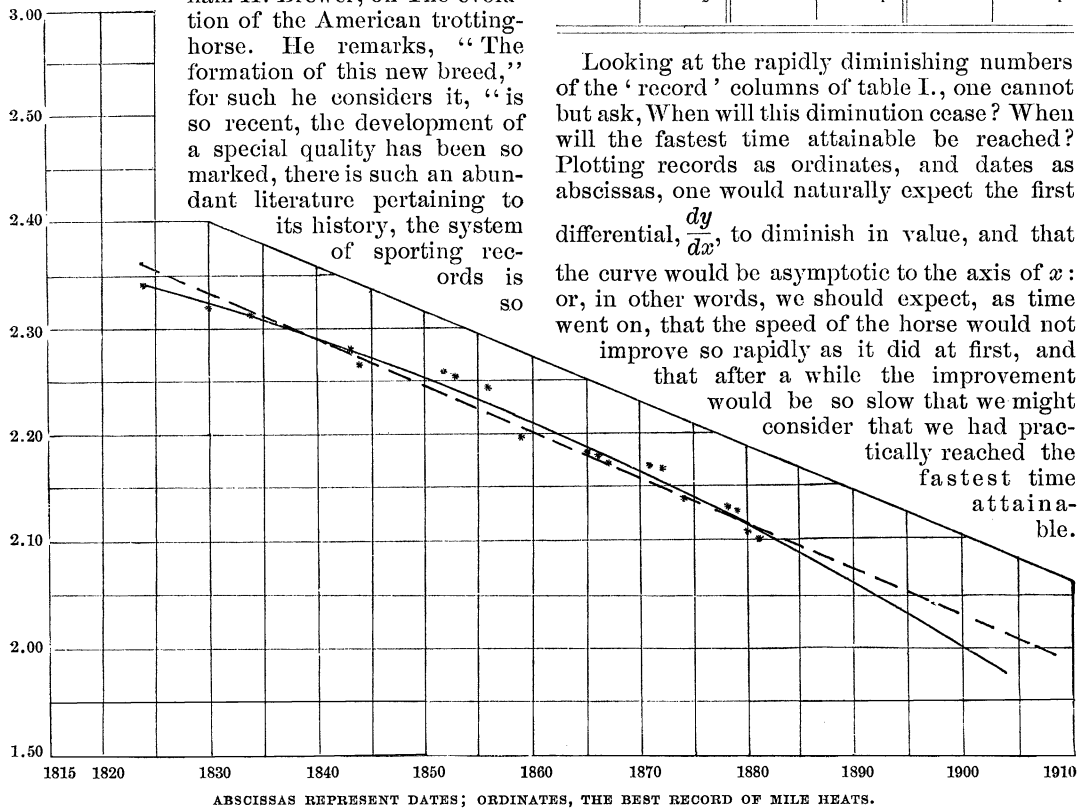
The engraving shows the model hanging in

the workshop at the Yale museum. The pillars between which it hangs are fourteen feet high. On the floor, in the back part of the room, is the mould of the body, and bases of the arms. At the left, against the table, is the mould for the under sides of the bases of the arms, and at the right, on the floor, one of the arm-moulds, with the two parts fitted together.

J. H. EMERTON.

HORSE-TROTTING FROM A MATHEMATICAL STAND-POINT.

IN the April number of the *American journal of science* is a very interesting article by William H. Brewer, on The evolution of the American trotting-horse. He remarks, "The formation of this new breed," for such he considers it, "is so recent, the development of a special quality has been so marked, there is such an abundant literature pertaining to its history, the system of sporting records is so



carefully planned and comprehensively conducted, and withal has become so extensive, that we have the data for a reasonably accurate determination of the influences at work which led to this new breed being made, the materials of which it is made, and the rate of progress of the special evolution." Towards the end of the paper are given some tables, which are copied in part beyond. The writer

concludes by hoping that some one will plot the curves which naturally suggest themselves, and determine "how fast horses will ultimately trot, and when this maximum will be reached."

I.—Best record of mile heats up to the present time.

Date.	Record.	Date.	Record.	Date.	Record.
1818	3.00	1852	2.26	1871	2.17
1824	2.40	1853	2.25½	1872	2.16¾
"	2.34	1856	2.24½	1874	2.14
1830	2.32	1859	2.19¾	1878	2.13¼
1834	2.31½	1865	2.18¼	1879	2.12¾
1843	2.28	1866	2.18	1880	2.10¾
1844	2.26½	1867	2.17¼	1881	2.10¼

Looking at the rapidly diminishing numbers of the 'record' columns of table I., one cannot but ask, When will this diminution cease? When will the fastest time attainable be reached? Plotting records as ordinates, and dates as abscissas, one would naturally expect the first differential, $\frac{dy}{dx}$, to diminish in value, and that the curve would be asymptotic to the axis of x : or, in other words, we should expect, as time went on, that the speed of the horse would not improve so rapidly as it did at first, and that after a while the improvement would be so slow that we might consider that we had practically reached the fastest time attainable.

But we find, with the exception of the first, that all the points lie very nearly on a curve which is convex upwards: in other words, that the rate of improvement of the record is increasing instead of diminishing, and that it will cross the two-minute line about the year 1901.

It is very evident that this state of things cannot go on indefinitely: otherwise we should in course of time have a horse trot a mile in no

time at all. So that our curve must sooner or later become a straight line, and ultimately concave upwards. Drawing a straight line which shall agree as nearly as possible with our observations, we shall find from it, that the speed of the trotting-horse is increasing at a nearly uniform rate of $4\frac{1}{3}$ seconds in ten years; so that, on this supposition, it would cross the two-minute line in 1907, and the one-minute line in 2045. It is highly probable that the curve will have become concave before the latter period; but it does not seem too rash to predict that a horse will be born before 1907 that can trot a mile in two minutes.

II. — Total number of horses capable of trotting in 2.30 or better.

Date.	No.	Date.	No.	Date.	No.
1843	1	1859	32	1871	233
1844	2	1860	40	1872	323
—	—	1861	48	1873	376
1849	7	1862	54	1874	506
—	—	1863	59	1875	—
1852	10	1864	66	1876	794
1853	14	1865	84	1877	836
1854	16	1866	101	1878	1,025
1855	19	1867	124	1879	1,142
1856	24	1868	146	1880	1,210
1857	26	1869	171	1881	1,532
1858	30	1870	194	1882	1,684

Table II. shows the enormous rate of increase of this new breed of animals, amounting to about twenty per cent a year. Treating the observations by the logarithmic method, we find, that, since 1864, the increase may, with a reasonable degree of accuracy, be represented by the formula $y = .0016 x^4$, where y represents the number of horses, and x the number of years since 1850. Thus, for 1882, we have $y = .0016 \times 32^4 = 1678$. Applying this formula, we find, that, if the present rate of breeding is continued, the trotting-horses of America in 1900, that can travel a mile in 2.30 or better, will number not far from 10,000.

WM. H. PICKERING.

THE ORIGIN OF CROSS-VALLEYS.¹

II.

RETURNING now to Virginia and Pennsylvania, we have to consider not only why the rivers there cross the mountains, but also why they flow to the south-east instead of to the north-west. Taking the last question first, we are forced to suppose that the north-westerly

slope, which must have existed at least up to the end of the carboniferous, was then or soon after reversed in the slow writhing of the surface. This is demanded by the lay of the land, and by the now small area of what must have been, in paleozoic time, a large crystalline land-mass. The slope being changed early in the growth of the folds, or before their beginning, the streams tried to make their way to the eastward; and the Hudson, Delaware, Susquehanna, Potomac, and James are the descendants of those that succeeded. Their rectangular courses, alternately longitudinal and transverse, bear witness to their defeats and victories. Lakes must have been numerous here once, though they are now all drained. It is known that rivers often chose cross-faults of small throw as points of attack in cutting their way through the growing ridges; and it is very probable that they made use of pre-existent valleys when they advanced over the old sinking land.

In considering the applicability of backward-cutting lateral streams to the production of our cross-valleys, we should test the past by the present, and examine such ridges as Kittatinny or Bald Eagle mountains in Pennsylvania, or Clinch mountain in Tennessee, rising between parallel longitudinal valleys, to see if they show embryonic cross-valleys in the more advanced stages of development. They do not. The continuity of their crest-line is most characteristic and remarkable: it very rarely departs from its line of almost uniform height. The exceptions are, first, the finished water-gaps, or transverse valleys, whose origin is in discussion; second, the occasional wind-gaps, or notches, which sometimes cut the ridge a third or half way to its base, and which are, we believe, always determined by small transverse faults; third, the less conspicuous serrations of small value. It is difficult to assign any reason why lateral streams should not now, as well as in former times, show us the later stages of breaking down the ridge on which they rise; and yet these almost-formed cross-valleys between adjoining longitudinal valleys are practically unknown in our Appalachian topography. The reason of their absence can hardly be, that there are now enough completed water-gaps for all practical purposes, and hence the lateral streams stop making any more; for this would imply a consciousness of the end that plays no part in geological operations, and we are therefore constrained to think that Löwl's explanation cannot apply to the Appalachians in any general way.

But it has a certain limited application in

¹ Concluded from No. 12.

the making of 'coves,' as may be perceived by the following considerations. The backward-cutting of a lateral stream can form a water-gap only where the longitudinal valley into which the lateral stream flows is decidedly lower than the longitudinal valley on the other side of the dividing-ridge; for, if there is no such difference of level, the pass through the ridge between the two will be eroded more and more slowly as it is lowered, and finally it will remain at practically a constant altitude above the valleys on either side. It can never form a drainage channel joining them: but, if the longitudinal valleys are of different heights, the result as described by Löwl may be produced; or, if a broad plateau-fold is bordered by a deep valley, its lateral streams may finally head up in coves or circular valleys, like those south of the west branch of the Susquehanna, and at many other points in the Appalachians. The geological map of Pennsylvania (1858) shows these admirably.

Now it may be asked, Are not the upper valleys of the Susquehanna, and of the other rivers that break through the Blue mountain, merely large examples of 'coves'? There are two objections to this explanation. First, what became of the head waters of these rivers before they had a south-easterly outlet? It seems most probable, that the many pre-existent streams in each river-basin concentrated their waters in a single channel of overflow, and that this one channel survives,—a fine example of natural selection. Second, how does it happen—notably in the case of the Susquehanna just above Harrisburg—that several deep water-gaps have been formed one behind the other? Such an arrangement might naturally result if the valley were antecedent; but it is difficult to account for if the several gaps result from the backward erosion of accidental lateral streams.

Löwl thinks that faults are greater obstacles to rivers than folds. He says, that even if river erosion could, under certain favorable conditions, keep pace with mountain folding, it does not follow that it could control a fault: for that would imply that the fault was formed gradually, and that its throw increased at a constant though imperceptible rate; and this he considers entirely unwarranted (408). It is certainly a difficult matter to understand the mechanics of such faults; and yet our ideas concerning them must conform to the facts as they occur in nature. In spite, therefore, of a natural preference for an active growth of faults, we are compelled, when we see streams running across them from the downthrow to the

upthrow side, to accord them a slow growth. Tennessee shows many examples of this paradoxical nature; and some of the faults thus disregarded, or, we might say, corrected, have a throw of several thousand feet. On the other hand, it cannot be denied that many faults have had a controlling influence on stream-courses; and we must therefore admit here, as above, the possibility of valley-cutting being stronger or weaker than orographic movements. The variety that is to be seen in the physical features of the earth, and that is consequently to be looked for in the conditions which determined them, is so great that it demands almost equal variety in the theories for their explanation.

W. M. DAVIS.

Cambridge, Jan. 12, 1883.

THE ORIGIN, AFTER BIRTH, OF ASPIRATION OF THE THORAX.

THE negative pressure in the pleural cavities, which plays such an important part in the respiratory mechanism of the adult mammal, and also exerts a marked influence upon the flow of blood and lymph, is known not to exist in unborn or stillborn mammals which have never breathed. It has hitherto been assumed, however, that it was established with the first inspiration; and all theories as to its mode of production have been controlled by this belief. Hermann, in an interesting paper (*Pflüg. archiv*, xxx. 276), shows that this assumption is incorrect. In infants which have lived and breathed after birth for periods of from one hour to eight days, there is found on experiment to be no negative pressure in the pleural cavity when the chest-walls are in their death position. This fact leads, necessarily, to important results in regard to the respiration of young mammals. Their lungs in expiration can contain hardly any of what in the adult is known as 'residual' air: they contain still some air imprisoned in the air-cells, and causing them to float in water. But this 'minimal' air is practically no more than what remains in a piece of adult lung squeezed between thumb and finger. Except this minute quantity, there is in the new-born mammal no stationary air. At each inspiration, air direct from outside enters the alveoli of the lungs; and, at each expiration, air from the alveoli is expelled, leaving the lungs practically empty. Hence the renewal of the air in the lungs is much more efficient than in adults. The high percentage of oxygen which the alveolar air must contain is probably correlated with the more active oxidations known to occur in the young animal. The question naturally arises, What is the object of the residual air in the lungs, and the negative pressure in the thorax, which we find established later? Hermann suggests three possible objects: 1°. Aspiration on the veins, promoting bloodflow to the heart; 2°. More uniform composition of air in the alveoli [and, we may add, more uniform temperature]; 3°. The presence of a certain store of air in the lungs in the case of a temporary stoppage of the breathing-movements. It remains to be seen at what age and rate the negative pressure in the thorax is developed. It is obviously brought about by a more rapid growth of the thorax than of the lungs.

H. NEWELL MARTIN.

PLANT-LIFE, PAST AND PRESENT.

THE opening lecture of the second course of 'Saturday lectures,' delivered at the National Museum in Washington, was by Mr. Lester F. Ward, assistant geologist U. S. geological survey, and honorary curator of fossil plants to the museum; the subject being 'Plant-life of the globe, past and present.'

The object of the lecture was to give some account of the progress which has taken place toward the adoption of a truly natural system of botanical classification. After describing and comparing the methods of Linné, of A. L. de Jussieu, of Adrien de Jussieu, and of modern botanists, the lecturer pointed out the objections which may be made to all of these, and then presented the outline of a system which aimed to exclude the objectionable features, and to accord with the results of the latest discoveries in structural botany, and especially with the teachings of paleontology, which he claimed to have been too much ignored by botanists. The proposed system was as follows:—

Cryptogams.	Cellular.			
Vascular.	Filicineae . .		{ Filices.	
			{ Rhizocarpeae.	
	Lepidophytae .		{ Equisetinaeae.	
Phenogams.			{ Lycopodiinaeae.	
			{ Ligulatae.	
Gymnosperms.	{ Cycadaceae.			
	{ Coniferae.			
Angiosperms.	{ Gnetaceae.			
			{ Monocotyledons.	
			{ Apetalae.	
			{ Polypetalae.	
			{ Dicotyledons.	
			{ Gamopetalae.	

type which have been found fossil at each geological horizon, and also the most reliable estimates that could be obtained of the number living at the present time in all parts of the world. It also showed the percentage that each type formed of the total known flora of each epoch. We give below a condensed view of this chart, which is all we have space to present.

Relative to this table, it should be explained, —

1. That the figures given for the living gymnosperms and dicotyledons are, in round numbers, those of Messrs. Bentham and Hooker, as stated for each genus and order in the 'Genera plantarum,' and which are here compiled, perhaps for the first time.

2. That the number of fossil species were collated from a great number of sources; Schimper's 'Traité de paléontologie végétale' being the basis, supplemented by data from all the more recent publications which were accessible, and by some unpublished data. Absolute completeness, however, was not claimed, but only such substantial accuracy as was deemed sufficient for the purposes of the lecture.

3. That under 'tertiary time' are included all the beds from the quaternary to the middle cretaceous; the latter being represented in this country by the Dakota group, and in Europe by the cenomanian. This is done because it is at the last-named horizon that the dicotyledons first appear, and because they appear here in such extraordinary profusion. Marquis Saporta has also made the vegetable tertiary to begin at this point.¹

The facts embodied in this table were further graphically illustrated by two diagrams, prepared by Ensign E. E. Hayden, U.S.N. The first of these showed, by means of accurately plotted curves and

Number of known species of fossil and living plants.

GEOLOGICAL PERIODS.	CRYPTOGAMS.						PHENOGAMS.								Total.
	CELLULAR.	VASCULAR.					GYMNOSPERMS.			ANGIOSPERMS.					
		Ferns.	Rhizocar- peae.	Equis- etinae.	Lycopo- dineae.	Ligulatae.	Cycadaceae.	Coniferae.	Gnetaceae.	Monocotyle- dons.	DICOTYLEDONS.				
											Apetalae.	Polypet- alae.	Gamo- petalae.		
Present time	35,000	3,000	100	30	500	400	75	300	40	25,000	12,000	35,000	40,000	151,445	
Per cent	23.10	2.00	0.05	0.01	0.32	0.25	0.04	0.20	0.02	16.50	8.00	23.10	26.41		
Tertiary time	302	202	7	27	2	5	19	253	3	446	1,285	1,650	499	4,700	
Per cent	6.43	4.30	0.15	0.57	0.04	0.11	0.40	5.38	0.06	9.49	27.34	35.11	10.62		
Secondary time	112	298	1	33	1	-	198	90	-	19	-	-	-	752	
Per cent	14.89	39.63	0.13	4.39	0.13	-	26.33	11.97	-	2.53	-	-	-		
Primary time	Carboniferous	19	664	3	81	298	-	67	54	-	-	-	-	1,186	
	Per cent	1.60	55.99	0.25	6.83	25.13	-	5.65	4.55	-	-	-	-		
	Devonian	29	35	-	4	16	-	5	5	-	-	-	-	94	
	Per cent	30.85	37.23	-	4.26	17.02	-	5.32	5.32	-	-	-	-		
Silurian	19	1	-	2	2	-	1	-	-	-	-	-	-	25	
	Per cent	76.00	4.00	-	8.00	8.00	-	4.00	-	-	-	-	-		

The claims of this scheme as the nearest approach yet made to the system of nature were supported, for the most part, on paleontological grounds. To do this, an elaborate chart was presented, giving the geological history of each of the principal types of vegetation. This was in the form of a tabular exhibit of the number of species belonging to each

colored areas, the development of each type of vegetation through the several ascending strata, the breadth of the areas at any epoch representing the prominence of the several types relatively to the entire flora of that epoch. The other diagram consisted of

¹ Le monde des plantes avant l'apparition de l'homme, p. 160.

a series of independent figures, designed to show the degree of development attained by each type at any epoch relatively to other epochs.

These charts and diagrams were thoroughly discussed; and the lecture closed with a few remarks on the genealogy of plants, illustrated by an arborescent figure showing one of the possible ways in which the present forms of plant-life may have been derived.

LETTERS TO THE EDITOR.

[Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.]

Intelligence of the crow.

JAPAN is the birds' paradise, as fire-arms cannot be carried except by special permit. Though their punishment of criminals is sometimes extremely cruel, to shoot birds for sport or for scientific purposes would never enter the heads of this kind-hearted people. I noticed, in many parts of the country, that the crow felt a sense of security, meeting man boldly, conscious that he is a benefactor—and acknowledged as such—by killing injurious grubs, even though he collect a few grains of corn in the operation. He scorns to fly at your approach, and fears not a stick pointed at him, which he never takes for a gun. He is as familiar in Japan as he is shy in America and Europe.

Another instance of this bird's intelligence came under my observation as I was walking among the crumbling arches of Caracalla's baths in Rome, in April, 1882. When near the walls, a stone nearly as large as my fist fell at my feet. Fearing a recurrence of what I supposed was an accident of perishing masonry, our party went farther toward the centre of the area. A second and a third fell near us; and, looking up, I saw some crows circling above our heads, one of which dropped a fourth from his claws. It seems that we had been strolling too near their nests in the walls; and they took this method to drive us away,—a very effectual one, as a stone of that size, falling from the height of sixty feet, was an exceedingly dangerous missile, and perhaps only prevented from being fatal by the failure of the bird to make allowance for the impetus given by its own motion. The aim was accurate, and the discharge right overhead; but, as both we and the bird were moving, it fortunately missed its mark.

SAMUEL KNEELAND.

Paleolithic man in Ohio.

In SCIENCE of April 13, p. 271, Professor Wright remarks that "no paleolithic implements have as yet been found [in Ohio], but they may be confidently looked for." It has seemed to me possible, from my own studies of the remains of paleolithic man in the valley of the Delaware River, that traces of his presence may only be found in those river-valleys which lead directly to the Atlantic coast, and that paleolithic man was essentially a coast-ranger, and not a dweller in the interior of the continent. If we associate these early people with the seal and walrus rather than with the reindeer, and consider them essentially hunters of these amphibious mammals rather than of the latter, it is not incredible. I submit that they did not wander so far inland as Ohio, nor even so far as the eastern slope of the Alleghanias; and we need not be surprised if paleolithic implements, concerning which there can be no doubt whatever,—for recent Indians made and used stone implements that are 'paleolithic' in character,—are not found in Ohio, or even in Pennsylvania west of the valley of the Susquehanna River.

Unquestionable evidences of paleolithic man in America have been found in the valleys of the Connecticut, Delaware, and Susquehanna Rivers, and probable traces of the same people in the valleys of the Hudson, Potomac, and James Rivers. This is an extensive range of territory, and one not too limited as the probable area occupied by a primitive people.

If we could accept without qualification the assertion occasionally made, that America's earliest race was pre-glacial, the difficulties that beset the study of paleolithic man would quickly vanish. I am disposed to believe it, upon theoretical grounds, but have met with no satisfactory demonstration that such was the case. In a recent lecture before the Franklin Institute of Philadelphia, Prof. H. Carvill Lewis remarked, "That man existed before the glacial epoch has been inferred from certain facts, but not satisfactorily proven."

Accepting the above conclusion, and coupling it with the assertion made by both Professors Wright and Lewis, that the melting of the great continental glacier occurred so recently as ten thousand years ago, we are compelled to crowd several momentous facts in American archeology into a comparatively brief space of time; and it becomes more probable that the fabricators of the implements found in post-glacial gravels came from some transatlantic continental area, and had not wandered far inland when met by southern tribes, who drove them northward, exterminated or absorbed them.

On the other hand, if the relationship of paleolithic man and the Eskimo is not problematical, and the latter is of American origin, then I submit that man was pre-glacial in America, was driven southward by the extension of the ice-sheet, and probably voluntarily retreated with it to more northern regions; and, if so, then in Ohio true paleolithic implements will surely be found, and evidences of man's pre-glacial age will ultimately be found in the once-glaciated areas of our continent.

CHAS. C. ABBOTT.

The copper-bearing rocks of Lake Superior.

Mr. Selwyn's courteous reply in SCIENCE, No. 8, to my letter in No. 5, calls for only a few remarks from me.

In his admission that I am right in asserting the existence of a great unconformity in the St. Croix region, between the basal sandstones of the Mississippi valley and the copper-bearing rocks, he yields the principal point for which I contend. It seems very unreasonable to me to extend the term 'Cambrian' over this unconformity; but, in the absence of any fossil evidence, I am relatively indifferent on this point. I only insist on the complete distinctness of the copper-bearing strata from the lowest sandstone of the Mississippi valley, and from the horizontal sandstone of the eastern end of the south shore of Lake Superior. Mr. Selwyn evidently does not appreciate that the St. Croix valley unconformity is not merely 'locally very great.' Our conclusions as to this unconformity are not based on any one local unconformable contact, but upon the fact, that, for a distance of over fifty miles in a north-westerly to south-easterly direction, the basal sandstone of the Mississippi valley lies horizontally athwart the courses of the tilted Keweenawan beds, overlying and burying the western termination of these beds, which are here disposed in synclinal form. Nor is the St. Croix Falls locality, described in the third volume of the Geology of Wisconsin, the only place in the St. Croix valley where the unconformity may be actually seen. Besides other places, it may be finely seen on Snake

and Kettle rivers, in Minnesota, where the Keweenaw beds are identical in all respects, even to the occurrence of interbedded porphyry-conglomerates and cupriferous amygdaloids, with those of Keweenaw Point.

As to the Animikie group, I have only to say, that I have not asserted its identity with the so-called Huronian rocks on the east shore of Lake Superior, spoken of by Mr. Selwyn, but merely its *probable* identity with the original Huronian of the north shore of Lake Huron, which neither I nor Mr. Selwyn have seen, and its certain identity with the iron-bearing schists of the south shore of Lake Superior. The term 'Huronian' has been so differently used by different members of the Canadian geological corps since the first establishment of the system, that much doubt must still remain as to whether there are two sets of schistose rocks north of Lake Superior, or not. This much, however, I regard as certain; viz., that the flat-lying Animikie rocks of Thunder Bay and northern Minnesota were once continuous with some of the folded schists lying north of them in northern Minnesota and Canada,—the Vermilion Lake iron-bearing schists, for instance,—although now separated from them by belts of gneiss and granite. The lithological differences between the Animikie rocks and the folded schists are often more apparent than real; while, in many respects, there is a very close lithological likeness. However, I do not expect, and indeed have no right to expect, acquiescence in my novel position as to the Animikie rocks until the evidence I have collected has been published. I am confident, that, with the evidence that I now have, in his hands, Mr. Selwyn would at least think the matter worth looking into.

With regard to the occurrence of volcanic ash in the Keweenaw series, I must acknowledge at once, that, so far as field-experience goes, Mr. Selwyn is far better equipped than I to judge of such materials, and that, not having seen Michipicoton Island, I am bound to accept his statement. I understood his first letter to indicate the occurrence of such ash in places which I had myself seen. Nevertheless, I bear in mind that a considerable school of English geologists has been long in the habit of calling almost any detrital rocks, not distinctly quartzose and associated with eruptive rocks, *volcanic ash*, when very often, at least, they might be simply derived by water-action from these rocks. Possibly there is some misunderstanding in our use of the term. Most of the detrital rocks of the Keweenaw series are volcanic detrital matter, in that they have been derived by water-action from the eruptive, massive rocks of the same series; but I used the term as applied to fragmental material produced by the volcanic action itself. I do not know of any *proof* of such an origin in stratified material, other than the vesicular character, and perhaps constant angularity, of the particles, which proof I have failed to find.

The discussion of such a question as the present one evidently cannot, however, be carried on satisfactorily in the pages of a journal; and I must ask my scientific *confères* to defer their judgment until my publications on this subject, now in type, are issued.

R. D. IRVING.

University of Wisconsin,
April 12, 1883.

Pairing of the first-born.

As regards the pairing of the first-born, my calculation of which called forth Mr. Hendricks's criticism, permit me to call attention to the following letter from Mr. Edmands, which I hope will set the matter

straight. I applied to Mr. Edmands, because mathematics is not my *forte*; and I now have the pleasure of thanking him for the very kind attention he has given this matter. CHARLES SEDGWICK MINOT.

Boston, April 24, 1883.

As J. E. Hendricks remarks in *SCIENCE* of April 13, p. 278, "the chance that the first-born male will pair with the first-born female is as one to ten;" but Dr. Minot's argument in *SCIENCE* of March 16, p. 165, depends upon "the probability of both parents" being first-born, as stated at the beginning of the last paragraph on p. 165. If we first restrict the case to the offspring of first-born males, the chance that both parents will be first-born is evidently one in ten. But in the remaining ninety per cent of the race there would be no case of both parents being first-born. Taking the race as a whole, out of one hundred pairs, one pair would be both first-born, nine would have the male only first-born, nine the female only, and eighty-one (9×9) neither male nor female first-born. This does not touch the question whether Dr. Minot is justified in giving no weight to the eighteen cases in a hundred, where only one individual of the pair is first-born.

J. RAYNER EDMANDS.

Cambridge, April 19, 1883.

Place the ten females in a row, and the ten males opposite them, with the 'first-born' opposite each other. The ten males are susceptible of $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10$ permutations, each of which furnishes a distinct system of pairing. Of these, $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9$ are possible without disturbing the juxtaposition of the first-born. The chance of their pairing will therefore be,

$$\frac{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9}{1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10} = \frac{1}{10},$$

as stated by Dr. Hendricks in *SCIENCE*, April 13, p. 278. Mr. Minot's solution is correct only upon the supposition that *one pair, and no more*, will be formed.

T. C. M.

JAMES CLERK MAXWELL.

The life of James Clerk Maxwell; with a selection from his correspondence and occasional writings, and a sketch of his contributions to science. By LEWIS CAMPBELL and WILLIAM GARNETT. London, Macmillan & Co., 1882. 16+662 p., 3 portr., 4 pl., facsim., etc. 8°.

JAMES CLERK MAXWELL was born in Edinburgh on the 13th of June, 1831. He died Nov. 5, 1879.

The late Professor Benjamin Peirce once said in the hearing of the writer, that great geometricians did their best work before they had reached their fortieth year. This can hardly be said of the mathematical physicist; for the constant accumulation of new facts tends to make mature years the most fruitful in results to the student who still preserves his mental and physical activity. Commoner men doubtless, in time, make good the premature loss to the world of a genius. Those epochs, however, in a nation's history, in which men of

scientific genius live to a mature old age, will always be considered important ones.

Maxwell was fortunate in possessing a father who early perceived the genius of his son, and directed his mind toward the study of mathematics and physics. He was also fortunate in springing from a race in which ability seemed to be hereditary. 'The Clerks' for two centuries had been associated with all that was most distinguished in the northern kingdom, from Drummond of Hawthornden to Sir Walter Scott. John Clerk, the father of James Clerk Maxwell, the subject of the present sketch, succeeded to the property of Middlebie, which descended to him from his grandmother, Dorothea, Lady Clerk Maxwell, and assumed the name of Maxwell. It is related of him, that he took the greatest interest in science, especially in practical science. In a letter to his son, then at Cambridge, who proposed to spend the Easter holidays at Birmingham, he wrote, "View, if you can, armorers, gun-making and gun-proving, sword-making and proving, *papier-maché* and japanning, silver plating by cementation and rolling, ditto electrotypes, Elkington's works, braziers' works by founding and by striking out in dies, turning, spinning teapot bodies in white metal, making buttons of sorts, steel pens, needles, pins, and any sorts of small articles which are cunningly done by subdivision of labor and by ingenious tools. Glass of sorts is among the works of the place, and all kinds of foundry-works, engine-making, tools and instruments, optical and [philosophical], both coarse and fine."

His acme of festivity was to go with a boon friend to a meeting of the Edinburgh royal society. It is said by those who knew both parents, that the element of practicality entered very largely into their natures. The fine spirit of genius, the great imaginative powers, were not especially evident in them. Perhaps if the father had had the speculative mind of the son, he might have turned him toward philosophy and literature. The possession, in the father, of great interest in practical and useful processes, doubtless influenced the son's future.

At an early age Maxwell showed that he inherited the curiosity of his father in regard to machines and the phenomena of nature. It is related, that, when he was two years and ten months old, "he has great works with door-locks, keys, etc.; and 'Show me how it does' is never out of his mouth." Throughout his childhood his constant question was, 'What's the go o' that?' He was especially interested in colors. 'That (sand) stone is red; this (whin) stone is blue.' — 'But how d'ye know

it's blue?' His aunt, Miss Cay, was heard to remark "that it was humiliating to be asked so many questions one could not answer, by a child like that." The picture given of the boy's pursuits—his great activity of body and mind; his delight in nature's moods; his love for the deep brown of the brook, the shifting play of light on the foliage, the colors of the wandering clouds; his moods of lying on his back, watching the clouds, and 'wondering'—shows the boy as father of the man. On stormy days he read voraciously every book within his reach, or spent his time in drawing, or inventing curious combinations of colors. The specimens of his early drawings show that he had an accurate eye, which might have made him an artist of fair talent. At the age of ten his tutor pronounced him slow to learn, probably judging him by old scholastic methods, which were ill fitted to bring out the child's tastes; and his father accordingly placed him at the academy in Edinburgh. Here the boy, who had been brought up apart from other boys, and had been accustomed to '*gang his own gate*' with youthful fancies unridiculed by the average unpoetical schoolboy, was much persecuted at first by his school-fellows, who were amused by his singular clothes and broad accent. He gradually made a place for himself, however, and discovered that Latin was worth learning, and Greek very interesting. It is related that he took the foremost place in Scripture biography and in English. In arithmetic, as well as in Latin, his comparative want of readiness kept him down. At the age of thirteen he remarks in a letter, "I have made a tetrahedron and a dodecahedron, and two other hedrons whose names I don't know." At this time he had not begun geometry; yet he had discovered for himself the nature of the five regular solids, and had also constructed out of pasteboard other symmetrical polyhedra.

His sense of humor is early apparent. In one of his letters, written at the age of eleven, he writes concerning his place in the class, "Talking about places, I am fourteen to-day, but I hope to get up. Ovid prophesies very well when the thing is over, but lately he has prophesied a victory which never came to pass." He enjoyed writing letters with curious illustrations drawn with pen on the margins, and subscribed himself Jas. Alex. McMerckwell, an anagram of his name. In one of these letters there is the first inkling of his poetic taste: "I made four lines of Latin one week. . . . But I am not going to try for the prize, as, when I lithp in numberth, it ith but a lithp, for the numberth do not come. . . .

But I am making English ones on the apparition of Creusa to Aeneas.

"O father! can it be that souls sublime
Return to visit our terrestrial clime?"

The story of his school-years, told in his life, is of great interest to the American boy who has been fitted for college at the old Latin school in Boston, or at the ordinary American academy. Writing Latin verses was a marked feature of the academy at Edinburgh. This practice is comparatively unknown in our schools and academies. The present writer remembers that the subject of geometry was finished, so to speak, in the Boston Latin school in 1863, in about three months. In the Scottish academy the boy's mind was evidently allowed to rest upon the subject much longer, and he was stimulated to do problems of a more or less inventive kind. It was said of Maxwell at the age of fifteen, that, from "some mathematical principle, he would start off to a joke of Martinus Scriblerus, or to a quotation from Dryden, interspersing puns and other outrages on language of the wildest kind, humming and hawing in spite of P——; or, in a quieter mood, he would tell the story of Southey's *Thalaba*, or explain some new invention." This seems to show that the Scotch boy had a wider intellectual atmosphere around him than falls to the lot of the average American boy. But Maxwell, it may be remarked, was not an average Scottish boy. At the age of fourteen he gained the prize for English verse, for a poem on the death of the Douglas, and also the mathematical medal.

At the age of fourteen he was much attracted to the subject of decorative painting, especially to the attempts of those who sought to reduce beauty in form and color to mathematical principles, and often discoursed upon the Greek patterns and on the forms of Etruscan urns. The consideration of this subject led him to contrive methods of drawing a perfect oval, and ovals in general. His father, who had watched his son's intellectual development with sympathetic interest, took his son's ovals to Professor James O. Forbes, of the University of Edinburgh, who thought that the simplicity and elegance of the boy's method entitled it to be brought before the Royal society. In the diary of the father we read, "M. 6. — Royal society with James. Professor Forbes gave account of James's ovals. Met with very great attention and approbation generally." From this time the boy evidently studied geometry by the inventive method, to which the father of Mr. Herbert Spencer has deservedly called attention.

Maxwell entered the University of Edinburgh at the age of sixteen. It is said of him at that time, that the originality and simplicity of his ways occasioned some concern to his conventional friends. He had a rooted objection to the vanities of starch and gloves. While at table he had an abstracted manner, as if occupied in studying the effects of refracted light in the glasses, or in devising some curious way of viewing objects. His aunt used to recall his attention by crying, 'Jamsie, you're in a prop' (mathematical proposition). His teachers had formed the highest opinion of his intellectual powers; and his companions enjoyed his quaint humor, and began to appreciate his high moral qualities, which were exemplified by his deep reverence for higher things, and his devotion to friends and to those who were suffering.

Between the ages of sixteen and nineteen he studied at the University of Edinburgh. His studies were multifarious, but he was especially interested in polarized light, the stereoscope, galvanism, rolling curves, and the comparison of solids. His paper on rolling curves was presented to the Edinburgh Royal society, Feb. 19, 1849, by Professor Kelland; "for it was not thought proper for a boy in a round jacket to mount the rostrum there." A paper on the equilibrium of elastic solids was also presented in the spring of 1850. It is related of him at this time, that he was regarded as a discoverer in natural philosophy, and a very original worker in mathematics. He is said to have felt the importance of cultivating the senses, and to have regarded dulness in that respect as a bad sign in any man. It is curious to notice, that he took great interest in the lectures of Sir William Hamilton on metaphysics. The views of the latter on the inferiority of the study of mathematics as a means of discipline to the study of philosophy and the classics, apparently did not diminish Maxwell's interest in the lecturer. The editor of the life of Maxwell remarks, in regard to Maxwell's interest in the lectures of Hamilton, "This is perhaps the most striking example of the effect produced by Sir William Hamilton on powerful young minds,—an effect which, unless the best metaphysicians of the subsequent age are mistaken, must be out of all proportion to the independent value of his philosophy."

It is a noticeable peculiarity of great mathematicians, that their latter years are much given to metaphysics. With Maxwell, however, the reverse was true. While at the University of Edinburgh, he seemed to be as

much attracted toward the study of metaphysics as toward mathematics, but hardly as much as to physics. As he grew older, the study of physics seemed to him more fruitful than that of mental philosophy.

His method of studying mathematics is often alluded to in his letters. Thus, in a letter to a friend, written at the age of sixteen, he says, "I read Newton's Fluxions in a sort of way, to know what I am about in doing a prop. There is no time of reading a book better than when you need it, and when you are on the point of finding it out for yourself, if you were able." Again, in another letter, in speaking of the division of his time: "Then I do props, chiefly on rolling curves, on which subject I have got a great problem divided into orders, genera, species, varieties, etc." He continually talks of doing 'props,' and apparently had a number upon which his mind was continually exercised. Nor was his method of studying physics less suggestive. In a letter dated Glenlair, July 5, 6, 1848, we read, "I have regularly set up shop now, above the wash-house at the gate, in a garret. I have an old door set on two barrels and two chairs, of which one is safe, and a skylight above, which will slide up and down. On the door (or table) there is a lot of bowls, jugs, plates, jam-pigs (jars), etc., containing water, salt, soda, sulphuric acid, blue vitriol, plumbago ore, also broken glass, iron and copper wire, copper and zinc plate, beeswax, sealing-wax, clay, rosin, charcoal, a lens, a Smee's galvanic apparatus, and a countless variety of little beetles, spiders, and wood-lice, which fall into the different liquids, and poison themselves. . . . I am making copper seals, with the device of a beetle. First I thought a beetle was a good conductor: so I embedded one in wax (not at all cruel, because I slew him in boiling water, in which he never kicked), leaving his back out; but he would not do. Then I took a cast of him in sealing-wax, and pressed wax into the hollow, and black-leaded it with a brush; but neither would that do. So at last I took my fingers and rubbed it, which I find the best way to use the black lead. Then it coppered famously. I melt out the wax with a lens, that being the cleanest way of getting a strong heat: so I do most things with it that need heat." He was busy at this age with experiments on polarized light and on colors. "I have got plenty of unannealed glass of different shapes; for I find window-glass will do very well, made up in bundles. I cut out triangles, squares, etc., with a diamond, about eight or nine of a kind, and take them to the

kitchen, and put them on a piece of iron in the fire one by one. When the bit is red-hot, I drop it into a plate of iron sparks to cool; and so on till all are done."

The years he spent in the University of Edinburgh were full of what might be called original work. He studied under Professor Forbes and Professor Kelland, and worked, "without any assistance or supervision, with physical and chemical apparatus." In 1850 he left Edinburgh for Peterhouse college, Cambridge, and, after a short residence in this college, left it for Trinity, in the expectation that the larger college would afford him ampler opportunities for self-improvement. His tutor says of him in 1853, "It appears impossible for Maxwell to think incorrectly on physical subjects." He looked upon him as a great genius, with all its eccentricities, and prophesied that one day he would shine as a light in physical science. This impression was shared, apparently, by students who were the friends of Maxwell. He seemed at this period to be in great spirits, and to thoroughly enjoy his college-life. At no time a narrow specialist, he opened his mind, while at Cambridge, to all the intellectual influences of the place. He became one of the club known as the 'Apostles.' He sought the society of classical men as well as that of the mathematicians. His progress at the university was watched by his father with keen and sympathetic interest. In a letter he writes, "Explain the pendulum experiment to me. You used often to speak of the retardation of the rotation of the earth by the friction of the tides. What is the phosphate of lime theory of mental progress?" And again: "Do you like the trig. lectures A? Tacitus is not new to you. His style must be congenial to a deep, half-sentence lecturer. You seem to have great gayeties with college parties with scientific dons. Do you take note of Stokes's experiments on the bands of the spectrum? Will they be suitable for repetition in the garret of the old house?"

The intimacy of the father and son, touched upon here and there in the life of the son, was a beautiful one. Maxwell's nature was capable of great devotion, and his feelings were exquisitely sensitive to kindness. His love for animals was but one expression of this abundant humanity. The editor of his life says, "In the autumn of 1850 the neighboring estate of Upper Corsock had been let to a shooting-party, one of whom remarked to me, what a pity it was that young Mr. Clerk Maxwell was 'so little suited for a country life.' I clearly recollect his look of exulting mirth when this

was repeated to him. . . . The moral of Wordsworth's Hart-leap well was not so much a principle as an instinct with him. I remember his once speaking to me of the subject of vivisection. He did not condemn its use, supposing the method could be shown to be fruitful, which at that time he doubted; but 'couldn't do it, you know,' he added, with a sensitive, wistful look, not easy to forget."

In his twenty-first year his poetical side and religious side found greater expression than before, and his great strength in mathematics made itself felt. It is related that he often shortened the long train of analysis of the tutor by giving a short geometrical solution; and, whenever the subject admitted, he had recourse to diagrams rather than to analysis. At the age of twenty-two, Maxwell was second wrangler, Routh being senior; and Routh and Maxwell were declared equal as Smith's prizemen. At this age we find him speculating upon electricity and magnetism, and engaged in researches on color.

At the age of twenty-five Maxwell was appointed professor of natural philosophy at Marischal college, Aberdeen. At this period of his life he began his paper on the structure of Saturn's rings. His letters at this period are extremely suggestive. The death of his father, and his engagement to Miss Dewar, daughter of Principal Dewar, gave a characteristic coloring to them. These great events in his life had a powerful influence upon his speculations. His devotional side found full expression; and the study of ethics and metaphysics seemed to be strongly controlled by that of science.

He writes after his engagement, —

"My lines are so pleasant to me that I think that everybody ought to come to me to catch the infection of happiness. This college-work is what I and my father looked forward to for long; and I find we were both right, — that it was the thing for me to do."

In the same letter he remarks, —

"I have observed that the practical cultivators of science (e.g., Sir J. Herschel, Faraday, Ampère, Oersted, Newton, Young), although differing excessively in turn of mind, have all a distinctness and a freedom from the tyranny of words, in dealing with questions of order, law, etc., which pure speculators and literary men never attain."

The period of Maxwell's life extending from twenty-nine to forty was very rich in intellectual work. His calculations upon the character of Saturn's rings led him to speculate upon the molecular theory of gases. In

1860 he presented a paper on Bernoulli's theory of gases to the British association; in 1862 we find him engaged with others in determining the electrical unit of resistance; he was also occupied upon an investigation of the ratio between the electromagnetic and electrostatic units of electricity; and his great work on electricity and magnetism was in progress. He speaks in his letters of wading through the works of German mathematical writers, and of the careful study of the results of Faraday. His intercourse with the latter was of the pleasantest character.

On one occasion he was wedged in a crowd attempting to escape from the lecture-theatre of the Royal institution, when he was perceived by Faraday, who, alluding to Maxwell's work among the molecules, accosted him in this wise: —

"Ho, Maxwell, cannot you get out? If any man can find his way through a crowd, it should be you."

The influence of Faraday's intellectual methods of thought can be plainly traced in Maxwell's later writings upon electricity. No one can understand Maxwell's intellectual growth at this time who has not read his great treatise on electricity and magnetism. In this book are embodied the results of long and continued study of the observed phenomena, and of the best methods of interpreting them by mathematics. In this treatise one can find his electromagnetic theory of light, upon which he spent much thought during this busy period of his life.

In 1870 he was appointed director of the Cavendish physical laboratory at Cambridge by the *consensus* of eminent men whose advice had been asked in regard to the best man for the position. Lord Rayleigh, who succeeded Maxwell as director, wrote to him at this time, —

Cambridge, Feb. 14, 1871.

"When I came here last Friday, I found every one talking about the new professorship, and hoping that you would come . . . What is wanted by most who know anything about it, is not so much a lecturer as a mathematician who has actual experience in experimenting, and who might direct the energies of the younger fellows and bachelors into a proper channel . . . I hope you may be induced to come: if not, I don't know who it is to be."

Maxwell, in a letter to the vice-chancellor of Cambridge, expressed the opinion that the "special researches connected with heat, which I think most deserving of our efforts at the present time, are those relating to the elasticity of bodies, and, in general, those which throw light on their molecular constitution; and the most important electrical research is the de-

termination of the magnitude of certain electric quantities, and their relations to each other." The Cavendish physical laboratory was not opened until 1874. Maxwell died in 1879, five years later. In this short term of office he left the impress of his genius upon the scientific work of Cambridge. Sir William Thomson has said, "There is, indeed, nothing short of a revival of physical science at Cambridge within the last fifteen years, and this is largely due to Maxwell's influence." We have said that no one can thoroughly appreciate the genius of the man who has not read his treatises on

electricity, on heat, and his various essays, which are soon to be collected and published.

His life, with its great expressions of reverence for higher things and its respect for true scientific work, is one to ponder over; and his correspondence is rich in literary suggestions, and enlivened by the play of humor. It will always be a source of gratification to Americans to know that the American academy of arts and sciences and the American philosophical society were the first of the foreign scientific societies to elect Maxwell a foreign honorary member.

WEEKLY SUMMARY OF THE PROGRESS OF SCIENCE.

MATHEMATICS.

The polar quadrilateral.—Given a conic and a polar quadrangle: the five quadrilaterals got by taking the poles of its vertices, or the pole of one vertex and the lines joining the other three, are polar quadrilaterals such that conics circumscribing their diagonal triangles osculate the given conic in the same six points. S. Kantor gives a geometrical proof of this theorem by showing that the six points in which a conic inscribed in a quadrilateral can be made to touch the given conic are the same for the five quadrilaterals, and that any one of the triply infinite number of conics with respect to which a fixed quadrilateral is polar osculates other conics of the system in the same six points in which it is touched by conics inscribed in the quadrilateral. He points out an application of the latter property to the determination of the points of inflection of the unicursal quartic obtained by a quadric transformation of the conic. — (*Math. ann.*, xxi. 299.) C. L. R. [754]

Theory of functions.—The second part of a paper by Rausenberger treats of single valued functions with non-interchangeable periods. It is not convenient here to do more than refer to this paper, as a review of it can hardly be given without introducing a good deal of algebraical work. The paper, however, as introducing a certain number of new and interesting ideas, is decidedly worthy of consideration. — (*Math. ann.*, xxi.) T. C. [755]

Impact of billiard-balls.—M. Resal has generalized some of the results obtained by Coriolis in his *Théorie analytique des effets du jeu de billard*. Coriolis has considered the two balls as being homogeneous, and possessing identical properties in every respect. M. Resal takes account of possible differences in the masses of the two balls, and in their moments of inertia with respect to a diameter, — two properties which might interfere very seriously with the play of even a skilful player. One of the principal results obtained by M. Resal is, that, during the instant of impact, the direction of the friction is not constant. The contrary was assumed by Coriolis. — (*Comptes rendus*, Oct. 16, 1882.) T. C. [756]

PHYSICS.

Acoustics.

Vibrations of membranes.—A. Elsas has studied the vibrations of both square and circular membranes, exciting them by connecting the middle of

the membrane with a tuning-fork by means of thread, attaching the thread to the membrane with sealing-wax. The nodes and loops were determined in the usual manner by the use of sand and lycopodium powder. Thirty different forks were used, and a great variety of membranes. The sound-figures showed a gradual change from one mode of vibration to another as the pitch of the fork was changed, thus verifying the results of Savart. — (*Beibl. ann. phys. chem.*, No. 2, 1883.) C. R. C. [757]

Photography of sound-vibrations.—Boltzmann has studied the vibrations of a plate actuated by the voice, using a method similar in many respects to that employed several years ago by Prof. Blake of Providence. A thin platinum plate was attached perpendicularly to the iron plate; and, by an application of the principle of the photophone, it was shown to vibrate in the same manner as the iron plate. By means of a solar microscope, an image of the shadow of the platinum plate was thrown upon a screen, the straight bounding-line of the shadow being condensed by a cylindrical lens. The screen was then replaced by a sensitized plate, moved rapidly at right angles to the line of light produced by the cylindrical lens, while the iron plate was made to vibrate by the voice. The bounding-line between light and shadow on the plate formed a curve whose nature varied according to the sound uttered. The curves due to the vowels are simple; those due to consonants, much more complex. — (*Phil. mag.*, Feb.) C. R. C. [758]

Optics.

Conditions of sight which affect accurate shooting.—Formerly the sight of a soldier as regards shooting was a matter of little consideration; but with the introduction of the Martini-Henry and other rifles, which are accurate at 1,500 yards, sound eyesight becomes an important element. Dr. Litton Forbes, surgeon-major in the Servian war, discusses the various changes taking place in the eye by which the sight is affected, and proposes to correct defective vision by means of a stenopæic sight-adjuster. This consists of a disk of colored glass, perforated with a pin-hole aperture, having a correcting-lens of colorless glass cemented to its back. The whole is to be worn in a spectacle-frame. — (*Journ. roy. united service inst.*, no. 118, 1882.) C. E. M. [759]

A new optical phenomenon.—Axenfeld describes the conditions of an experiment in which straight lines, a little on the near or far side of the

distance for which the eye is focused, appear curved. The explanation of the phenomenon is essentially the same as that of 'Scheiner's experiment.' The author suggests that it may be employed in the construction of an optometer. — (*Pflüg. archiv*, xxx. 288.) H. N. M. [760]

Heat.

Thermometry. — In a recent communication Prof. Cleveland Abbé has reviewed the subject of the determination of the temperature of the air at a given locality, and described an original device. Beginning with the simple hanging of the thermometer in the open air, he proceeded to describe and point out the defects of the various methods of exposure of the past and present, — the thermometer in the shade, the Glaisher screen, the Stevenson screen and double-louvre screens in general, the double metallic cylinder shelters of Jelinck and Wild, the silver-thimble screen of Regnault, the whirling thermometer of Saussure and others, and Joule's method. The method devised by himself in 1865, and practised for a short time at Pulkova, consisted in constructing a very perfect louvre screen, within which were established black-bulb and bright- or silvered-bulb thermometers. One of these was greatly influenced by radiations from the surrounding screen, and the other very little; and the difference of their readings enabled the effect of radiation to be computed and eliminated. Provided the theory of the action of the bright and black bulbs is perfectly understood, they can be employed in conjunction by meteorologists and physicists without a screen, and even in sunlight.

The formula used for reduction at Pulkova was

$$t_a = t_s + c(t_b - t_s),$$
 in which t_a is the temperature of the air, t_s and t_b are the readings of the bright-bulb and black-bulb thermometers, and c is a co-efficient to be determined experimentally for each pair of instruments. Quite recently Prof. William Ferrel has made a theoretic investigation of the co-efficient, showing that it is not strictly constant, but varies with the velocity of the air-current passing the bulbs. Representing by r_s and r_b the radiating powers of the bright and black bulbs, by B , B' , and B'' , certain constant co-efficients depending on the size, conductivity, and specific heat of the bulbs, and by v the velocity, he writes the full formula thus: —

$$t_a = t_s + \frac{1 + \frac{B r_b}{B' + B'' v}}{r_b - 1} (t_b - t_s).$$

— (*Phil. soc. Wash.*; meeting March 24.) [761]

Electricity.

Determination of surface of winding. — F. Himstedt gives a method of determining experimentally the *windungsfläche* of a bobbin by suspending it in the magnetic meridian, and comparing the deflection due to a given current with that due to another current in a coil whose constants can be directly measured. By hanging the two coils rigidly connected upon the same suspension, and passing the current first in the same and then in opposite directions through the coils, he obtains

$$\frac{S + s}{S - s} = \frac{I' \tan \phi}{I \tan \phi'},$$

where ϕ represents the deflection when the current is in the same direction. This formula renders necessary only the measurement of four angles. The paper of F. Kohlrausch which suggested this is given in

full in *Ann. phys. chem.*, iv. — (*Ann. phys. chem.*, iii.) J. T. [762]

Telephony. — At a recent meeting of the Society of telegraph engineers and of electricians, J. Munro described some new forms of microphonic transmitters. Among them was one consisting of two pieces of wire gauze held together by a magnet. In another form the microphonic contact was between the links of a short stretched chain. No details of practical trials are given. Mr. Stroh described an experiment in which he showed, by the use of a mirror and screen, that, in the case of one carbon cylinder resting across another, the upper one was raised $\frac{1}{2,000}$ mm. during microscopic contact. — (*Electrician*, March 17.) J. T. [763]

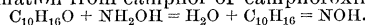
The Ayrton and Perry erg-meter. — Professor Perry gives a proof of the principle of the erg-meter, which measures the work done by a current by means of its electro-magnetic retardation upon a pendulum-bob. — (*Ibid.*) J. T. [764]

Conti's system for neutralizing induction. — One of two parallel wires is bent upon itself at one point of its course into a long, rectangular loop. The current in the outer side of this rectangle is opposite to that in the straight part of the wire, and may be brought near enough to a neighboring line to neutralize the mutual induction. — (*Electr. rev.*, Feb. 24.) J. T. [765]

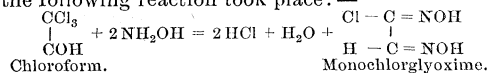
CHEMISTRY.

(Organic.)

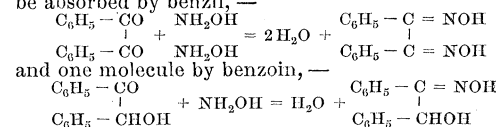
The hydroxylamine reaction. — Generalizations of this reaction are still in progress in the laboratory of V. Meyer. E. Nägeli obtained from mesityloxide, mesityloxime ($C_6H_{10}=NOH$); from phoron, phoroxime ($C_9H_{14}=NOH$); from allylacetone, allylacetoxime ($C_6H_{10}=NOH$); and from suberone, suberoxime ($C_7H_{12}=NOH$). Of still greater interest was the formation from camphor of camphoroxime, —



This reaction is a strong indication of the ketone character of camphor. Hydroxylamine was without action upon borneol and menthol. With chloroform the following reaction took place: —



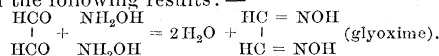
Max Wittenberg and V. Meyer employed the hydroxylamine reaction to prove the constitution of benzil and benzoin. If the formulae hitherto accepted are correct, two molecules of hydroxylamine should be absorbed by benzil, —



and one molecule by benzoin, —

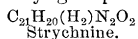
$$\begin{array}{ccc} C_6H_5-CO & + & NH_2OH \\ | & & | \\ C_6H_5-CHOH & + & NH_2OH \end{array} = H_2O + \begin{array}{c} C_6H_5-C=NOH \\ | \\ C_6H_5-CHOH \end{array}$$

On trial it was found that one molecule only of hydroxylamine entered into the reaction in either case. To make sure that hydroxylamine acts the same upon the group $-CO-CO-$ as upon the group $-CO-CH_2-$, the reaction was tested with glyoxal, with the following results: —



Benzil cannot, therefore, be a substituted glyoxal. These investigations will be continued in different directions to determine which of several possible formulae represents its constitution. — (*Berichte deutsch. chem. gesellsch.*, xvi. 494, 500.) C. F. M. [766]

The alkaloids of nux vomica.—On heating brucine in sealed tubes with concentrated hydrochloric acid, W. A. Shenstone found that the tubes opened with great pressure, and that methyl chloride escaped in large quantity. The formula of brucine may be regarded as derived from that of strychnine, by replacing two hydrogen atoms in the latter by two methoxyl groups:—



For the purpose of testing this hypothesis, the decomposition with hydrochloric acid was performed on a quantitative basis, which gave 79 per cent of the amount required for two methoxyl groups. When the contents of the tubes were dissolved in water, alkalies precipitated a base which proved to be too unstable for examination. The results obtained with hydriodic acid were still less satisfactory. Experiments will be next tried with strychnine. — (*Journ. chem. soc.*, ccliii. 101.) C. F. M. [767]

Certain substituted acrylic and propionic acids.—Dr. C. F. Mabery described several acids belonging to these series, which he had obtained in various ways. By the addition of chlorine to β -dibromacrylic acid, a dichlorodibrompropionic acid ($\text{CBr}_2\text{Cl} - \text{CHCl} - \text{COOH}$) was formed, which will be designated as the γ -acid, to distinguish it from the α - and β -dichlorodibrompropionic acids previously investigated. A molecule of hydrobromic acid was removed from the γ -acid by the action of aqueous baric hydrate, with the formation of a dichlorobromacrylic acid ($\text{CBrCl} = \text{CH} - \text{COOH}$). In like manner, from the α - and β -acids, baric hydrate removed hydrobromic acid, giving the corresponding substituted acrylic acids, whose structure is yet to be determined. It was hoped that a chlorine addition-product of brompropionic acid could be formed, since it would serve as a means of comparison; but on trial it was found that four chlorine atoms were taken up, instead of two, forming tetrachlorobrompropionic acid ($\text{CBrCl}_2 - \text{CHCl}_2 - \text{COOH}$); melting-point, 225°. Chlorine was also absorbed by chlorbromacrylic acid. From the resulting trichlorobrompropionic acid ($\text{CBrCl}_2 - \text{CHCl} - \text{COOH}$) baric hydrate eliminated hydrobromic acid, with the formation of trichloracrylic acid ($\text{CCl}_2 = \text{CH} - \text{COOH}$). These substances will be submitted to further study. — (*Harvard chem. club*; meeting April 24.) [768]

AGRICULTURE.

Rancid butter.—According to Hagemann, the peculiar properties of rancid butter are due to the presence of free butyric acid, and other volatile fatty acids. These are set free from the glycerides of the butter by the action of the lactic acid arising from the fermentation of the small quantity of buttermilk retained by the butter. That the liberation of butyric acid itself is not due to a fermentative action, was shown by the fact that all attempts to render butter rancid by adding to it the butyric ferment failed, and also by the fact that rancid butter failed to infect fresh butter. That the explanation given above is an adequate one, was shown by mixing both lactic acid and other dilute acids with butter or with pure butter-fat, the fat speedily becoming rancid in all cases. The same effect was produced on artificial butyric. To prevent butter from becoming rancid, the buttermilk should, in the first place, be removed as thoroughly as practicable. In the second place, any thing which will prevent the lactic fermentation will, of course, remove the cause of the evil. The author does not enter into a consideration of the most suitable means of doing this, further than to

point out that acids (such as salicylic acid) are not applicable, since they themselves are liable to act on the fat, and render it rancid. — (*Landw. vers. stat.*, xxviii. 201.) H. P. A. [769]

Ropy milk.—Schmidt finds that the ropiness of milk, which is sometimes observed, is caused by the action of a microscopic organism, which he describes, upon the milk-sugar. The same organism acts also upon cane and grape sugar and on mannite, converting them into a substance resembling vegetable mucilage in its properties. Small quantities of acid are produced, but no carbon dioxide. The fermentation appears to resemble, if not to be identical with, the mucilaginous fermentation of wine. The organism acts most energetically at 30°–40° C., and is destroyed by heating the fluid containing it to 60° C. or over. Freezing does not destroy it; and, if dry, it withstands a temperature of 100° C. Only comparatively large quantities of antiseptics prevent its action. — (*Landw. vers. stat.*, xxviii. 91.) H. P. A. [770]

GEOLOGY.

Geology of Brazil.—Professor Edward D. Cope made a communication based upon a collection of vertebrate fossils from Brazil, recently placed in his hands for study. As his examination of the material was not yet completed, he could only allude to the leading points of interest in connection with the geology of the United States and western Europe. The localities in which the fossils in hand were found are all south of the Amazon River. The eastern and western ranges of mountains correspond to our Alleghany and Rocky Mountains, and are approximately of the same age. A cretaceous formation is found in the neighborhood of Pernambuco. There are bare fossiliferous deposits near Sergipe, while the beds near Bahia are evidently lacustrine. The fossils from Pernambuco include several genera of sharks, and a genus of crocodiles identical with *Hyposaurus* of New Jersey. There is found with these a fine genus of rays, the teeth of which were described. These genera indicate this cretaceous formation to be near the top of the series, corresponding to the Maestricht chalk, or our number 5. At Maroin was found a new species of fish of the genus *Pycnodus*. He believed it to belong to the order *Isopondyli*; although it is very different in general form from the herrings, salmons, and other recent fishes belonging to the order. The form of the basilar bone of the pectoral fin, which the speaker considered of first-rate importance as indicating the relationship of the genus, was observed, and indicated that the position assigned was the correct one. The region about Bahia furnishes many fishes and saurians, but no cretaceous mammalia have as yet been discovered. There are two species of herring, — a small one, six inches long; and a large one, two feet long, resembling *Hyodon* and *Chirocentrus*. Crocodiles and dinosaurs are abundant, the former indicating higher beds than those at Pernambuco. A gavial resembling *Holops* of the New-Jersey cretaceous No. 5 was also found in these beds, which may be said to represent the Laramie deposits of the western United States. A tertiary horizon in Bahia has so far produced but one fossil, — a new species of *Toxodon*. The age is pampean. In San Paulo the beds seem to be Permian, and have yielded one batrachian form, which may, however, be carboniferous. The head bones of a large fish, the locality of which was not known, were also described. During the pliocene period the vertebrate fauna of Brazil was very distinct from that of North America; but the fossils now being studied

indicate a marked similarity in earlier periods. — (*Acad. nat. sc. Philad.*; meeting April 10.) [771]

Lacustrine formations of St. John, N.B. — As studied in the deposits of Lawlor's Lake, G. F. Mathew finds these to have begun about the middle of the terrace period, when the sea, which had previously submerged this portion of the coast to a depth of 200 feet, had so far shoaled as to bring up the land within 65 feet of its present level. During the interval between this epoch and the present time, a series of layers has been deposited, resting upon the marine *Saxicava* (or *Macoma*) sands below, and consisting, in succession, of lacustrine clays, lacustrine peat, peaty marl, and pure marl, to a depth of about 81 inches. From the character and relations of the deposits, together with the vegetable and animal remains which they contain, he finds it possible to trace out a number of successive phases in the lake-history of the region, accompanied, probably, by equally marked climatic differences. Among the plant-remains observed, the most interesting are those of the *Characeae*, of which particular descriptions, accompanied by figures, by Dr. T. F. Allen, are given. In addition to the spores of *Chara*, fragments of wood (some of them gnawed by the beaver), bark, cones of evergreen trees, bud-scales and leaves, and fruits of several species of land-plants, occur. A small fragment of charcoal was also found some distance below the surface, indicating, probably, the presence of man. The character of the plants is regarded as presenting a more northern facies than those dwelling in the same region to-day. The variations of the molluscan fauna attendant upon the changes in the condition of the lake are especially interesting, and have been made the subject of particular study by Prof. Hyatt. — (*Bull. nat. hist. soc. N.B.*) L. W. B. [772]

Lithology.

The Cheviot andesites and porphyrites. — The Cheviot district is composed largely of a series of quartzless eruptive rocks, to which the name 'porphyrite' is usually applied. They have a compact felsitic groundmass porphyritically enclosing numerous feldspars. The color is generally dark purple or red. They are much altered; and amygdaloidal varieties are found. In addition to the ordinary porphyrites, there occur masses of volcanic ash and breccia, and also a rock known as pitchstone porphyrite. These porphyrites have been described by Teall under the name 'andesites,' regarding them as more or less altered andesites.

Mr. Teall describes the mineral constituents as feldspar, pyroxene, magnetite or mennacanite (a glassy base containing various devitrification products), apatite, and hematite or biotite. The feldspars contain numerous inclusions of the base, and are principally plagioclase. The pyroxene is in elongated, octagonal, and irregular crystals and grains. The crystals are sometimes twinned, and he regards them as augites. The inclusions in the augite are glass cavities and colorless microlites. The groundmass is described as a 'felted aggregation of microlites in a glassy base.' The present writer has preferred to denominate this as a 'felty base.' The microlites of the felty base Teall regards principally as feldspar. The alteration products appear mainly to be siliceous. The age is stated to be 'post-silurian and pre-carboniferous.' Some specimens were later examined by Dr. H. Rosenbusch of Heidelberg, the leading European lithologist. He found that part of the pyroxenic constituent was orthorhombic, probably hypersthene, while the remainder is augite.

The constantly increasing discovery of other minerals besides augite, in the andesites, is leading, in the present system of nomenclature, to a series of distinct names for rocks structurally and chemically alike, and will probably in time cause the abandonment of the mineralogical nomenclature of rocks. In this case it should lead to the employment of the term 'andesite' alone. — (*Geol. mag.*, March, 1883.) M. E. W. [773]

GEOGRAPHY.

(Arctic.)

Northern notes. — Later advices have been received from the British party at Fort Rae. After experiencing a miniature shipwreck on Great Slave Lake, they arrived at Fort Rae in the latter part of August. Sept. 1, meteorological, and, two days later, magnetic observations were begun. Winter set in Nov. 1. The minimum temperature of the air to Nov. 30 was -43° C. The latitude of Fort Rae was determined to be 64° N., a degree farther north than previously supposed. Corrections in the position and shape of Great Slave Lake also seem necessary. The party were well, and work progressing favorably. They expect to return in October, 1883.

The plans of Baron Nordenskiöld for the present summer in Greenland have been in part made public. South-west Greenland is to be visited, and a study of the inland ice from that direction is contemplated. Later in the season, when the usual lane of water forms between the pack-ice and the south-east shore north from Cape Farewell, the party will proceed in *umiaks*, or sealskin canoes, as far as circumstances will admit, with the view of reaching, at the head of some of the fiords, the highlands which exist in east Greenland, and which are believed to be partly free from glaciers. Traces of the ancient Norse colonies at Öst-bygd are among the things to be sought for, though the present weight of evidence is in favor of the theory that these colonies were on the south rather than on the east coast, and that they are represented by the well-known stone ruins of south Greenland. — W. H. D. [774]

Siberian notes. — Number four of the quarterly *Ivestia* of the imperial geographical society for 1882 (printed 1883) contains an article by N. S. Shtukin on 'Popular traditions of eastern Siberia,' which contains much interesting matter, and some amusing instances of ideas associated by the residents with certain ancient monuments. Another by the same author is, 'An explanation of certain picture-writings on the cliffs of the Yenisei River.' These are figured, but are not particularly remarkable, except as being the work of invaders from the far south, perhaps Persians. Camels and pheasants are among the animals represented. U. V. Arsenieff discusses the consequences of early publications on, and explorations of, the Amur River. Bussé continues his valuable (separately paged) bibliography of the literature of the Amur region. The first edition of this bibliography, containing 522 titles, appeared in 1874. The present edition is brought down to 1881, the forty-eight pages already published including 973 titles. The work, which will probably be completed in the next number, is announced to contain, in all, 1,416 titles, divided under appropriate subjective subheads, but catalogued by authors. Of the proposed bibliographies of Hoevert and of the academy of sciences, nothing has lately been heard, which makes the result of private enterprise so much the more welcome. Bussé's titles are condensed, but sufficiently full for reference, and a large proportion refer to articles in Russian periodicals. — W. H. D. [775]

(Africa.)

Abbé Guyot on eastern Africa.—This enterprising missionary leader gives a summary of the difficulties encountered in entering Africa from Zanzibar in his several expeditions since 1879. His party included at times as many as six hundred persons, among whom brawls were very frequent, and desertion and robbery were prevented only by the strictest watch. In passing the numerous Ugogo villages, there was always delay and much palaver concerning the imposts collected of travelling parties. The fever presented the greatest danger. Sixteen of his thirty-five missionaries died of it in three years, and four more were killed by the negroes. Bad reports are spread by the Arabs about the Europeans, who are represented as woman-stealers and cannibals. The abbé bought and brought back with him four native children, who are now baptized and learning Latin, as preparation for the study of medicine; for as doctors they can exert the greatest influence. Guyot was considered a great magician, because he cured a native sorcerer who was unable to cure himself. It was hoped that the Louaha, flowing from the country east of the lakes to the ocean, might prove an easy means of communication with the interior; but it was found unnavigable. Large game was common, and gave plenty of food for cheap living for the caravans. The natives call 'gli, gli!' when hunting the hippopotamus; and, if within hearing, it rises from the shallow, muddy banks of the river, and comes towards them. This was tried many times, and always proved successful. The friendly native tribes are good-hearted; but they must be allowed their own peculiar ways, such as shouting and dancing all night to do honor to the white travellers to whom they had presented food. The abbé hopes soon to go to western Africa, and ascend the Kongo. — (*Comptes rendus soc. géogr. Paris*, 1883, 44.) W. M. D. [776]

Climate of the upper Senegal.—M. Colin, physician of Commandant Derrien's topographic party to the upper Senegal in 1880-81, divides the year there into a dry and a wet season, and two transition periods,—the dry season, from Nov. 15 or Dec. 1 to March 15, with nights and early morning hours cool, and days supportable; transition, from March 15 to May 15, still dry and healthy, but very warm and uncomfortable for Europeans; the rainy season, from May 15 to Oct. 15, cooler and often cloudy, without evaporation from the marshes, and hence still healthy; the second transition, from Oct. 15 to Nov. 15 or Dec. 1, still somewhat rainy, but with subsidence of rivers and drying of low plains, excessively unhealthy. — (*Comptes rendus soc. géogr. Paris*, 1883, 86.) W. M. D. [777]

Country of the upper Niger.—Commandant Gallieni's second paper gives many details on the hydrography and population of this region, and a few notes on its geology. The rocks are chiefly horizontal sandstones, showing barren plateaus, separated by fertile valleys, in which the streams are subject to rapid and regular floods, rising in June, and falling in December. The Niger is considered in three parts. The upper stream begins at the rocks of Sotuba, ten kilometres below Bamako, and extends through the broken country to its head waters, but even here probably in part navigable for small steamboats. The middle course includes the least-known part of the river from the rocks of Sotuba to the falls of Busa. Here the stream flows in numerous channels through a flat country, which it enriches. An active river-trade in slaves, cattle, gold, etc., is carried on between large villages on its banks. This division is more navigable than the first. The lower course

extends from the falls of Busa to the sea, and has often been ascended a considerable distance by trading-vessels. The total length is over 2,000 miles. Several of the towns described have well-constructed fortification walls, which are illustrated by plans and figures. On the assault of the village Gubanko in 1881, a hundred cannon-shot were needed to make a breach two or three metres wide. — (*Bull. soc. géogr. Paris*, 1882, 616.) W. M. D. [778]

BOTANY.

Cryptogams.

Ohio fungi.—In a paper on the Mycologic flora of the Miami valley, Mr. A. P. Morgan has given descriptions of eighty species of *Agaricus* belonging to the division *Leucospori*, found in south-western Ohio. The paper is accompanied by four colored plates, in which are figured six new species of *Agaricus*. — (*Journ. Cinc. soc. nat. hist.*, vi.) W. G. F. [779]

Diseases of trees.—The third part of the *Untersuchungen aus dem forstbotanischen institut* of Munich contains several articles on the diseases of woody plants caused by fungi. Dr. H. Mayr has a paper on the disease of maples, lindens, and horse-chestnut, caused by *Nectria cinnabarina*. Prof. Robert Hartig describes a new species, *Rhizomorpha* (*Dematophora*) *necatrix*, which he considers to be the cause of the root-rot in grape-vines. The *Rhizomorpha* produces conidia, which are figured by Hartig; but he was unable to find ascospores of any kind. While recognizing that the root-rot is caused by a species of *Rhizomorpha*, he differs from Millardet and Frank, who consider that the *Rhizomorpha* is the same as *R. fragilis*, which develops into *Agaricus melleus*; and, on the other hand, he differs from Prillieux, Thuemen, and others, who attribute the rot to a growth of *Roesleria hypogaea*, which Hartig considers to be merely a saprophyte which occasionally develops on the diseased roots. Hartig calls attention to the fact that in Germany the white pine of the United States (*Pinus strobus*) is especially susceptible to fungous diseases, and mentions several destructive fungi which are prone to attack it: among others, he cites *Peridermium pini*. In this respect the experience of German mycologists does not agree with observations made in this country, where the white pine is apparently less liable than some other species to attacks of the *Peridermium*. — W. G. F. [780]

Insects and the spermogonia of Uredineae.—For several years Rathay has been studying the relations between the rust-fungi and certain insects which visit their spermogonia to feed upon the spermatia and a sugary excretion which is found with them. The fragrance of the spermogonia of a number of species—e.g., *Puccinia suaveolens* of the Canada thistle—has been noticed by everybody who has studied these fungi; and the brightly colored spots in which they occur is equally well known. What benefit the fungi derive from the visits of ants and other insects is still to be shown, and will probably remain a mystery until the true function of spermatia is understood; but there is some reason for believing that the color, fragrance, and sweet secretion of their spermogonia are designed, like the similar peculiarities of many phenogamic flowers, expressly to attract these visitors. — (*Denkschrift. wien. akad.*, xlii.) W. T. [781]

Phenogams.

Notes on Echinocactus.—Mr. Thomas Meehan announced the discovery of sensitive stamens in *Echinocactus Whipplei*. The motion of the stamens, when touched, was not instantaneous, several seconds

sometimes elapsing before the effect was observed. The flowers of this species are unable to expand to any great extent, on account of their short tube surrounded by strong and stiff spines. If the flowers could expand, as in *Opuntia*, and the stamens lie flat, as in that genus, the motion might be equal. As in *Opuntia*, the motion was not always up towards the pistil, but might be horizontal, to the left or to the right: there seemed to be no rule. The bending was from the base, as the filament retained a perfectly straight line during the movement. Mr. Meehan further remarked, that, in descriptions of cactaceous plants, the relative length of petals or stamens to the pistil was often given. He had observed, that in many species, near the period of the ejection of the pollen from the anther-cells, the stamens and style were of about equal length, but that the latter continued to grow after the maturity of the anthers, and, in *Echinocactus Whipplei*, would finally reach to near half an inch above. He had not been able to get any genera of Cactaceae to fruit under cultivation, except *Opuntia*, unless they were artificially pollenized. By the application of the flower's own pollen to the stigma, they usually perfected fruit. His specimens of *Echinocactus Whipplei* and *E. polyancistrus* had bright purple flowers, although the latter were usually described as yellow or greenish. — (*Acad. nat. sc. Philad.*; meeting April 10.) [782]

The relations of heat to the sexes of flowers. — Mr. Thomas Meehan remarked that he had observed that a few comparatively warm days in winter or early spring would bring the male flowers of monoecious plants to maturity, while the female flowers remained to advance only under a higher and more constant temperature. He believed this accounted for their frequent barrenness. Last spring the male flowers of a specimen of *Corylus avellana* were past maturity before the appearance of action in the female flower-buds. There were consequently no nuts on this tree last season. The present season was one of unusually low temperature, and the hazel-nut had not had its male blossoms brought prematurely forward. The male flowers were showing their anthers, while the female buds had their pretty purple stigmas protruding. He could therefore predict with confidence a full crop from the tree which the season before was barren. — (*Acad. nat. sc. Philad.*; meeting April 10.) [783]

(Systematic.)

Grasses. — Dr. Vasey proposes to publish, in connection with F. L. Scribner, a full catalogue of North-American grasses, and in a circular gives the names merely of twenty-nine new species and varieties, mainly based upon recent collections, but as yet unpublished. Mr. Scribner continues his list of the grasses of Pringle's collection in Arizona and California, giving descriptions of the less familiar species. He also describes a new *Poa* from the head waters of the Sacramento, and a viscid species of *Diplachne* from near Tucson; though of the latter he says, "It is not improbable that it has already been described in works not accessible." — (*Bull. Torr. bot. club*, March, 1883.) s. w. [784]

New ferns. — Mr. Lemmon's researches in the Huachuca Mountains, near the boundary-line in Arizona, add several species to the list of United-States ferns. Prof. Eaton describes five such species, previously known only from Mexico or farther south, — a *Polypodium*, a *Notholaena*, a *Pellaea*, a *Cheilanthes*, and two *Aspleniums*. He adds a new *Notholaena*, from California and Arizona, hitherto confused with *N. candida*, and notes the discovery of *Asple-*

nium montanum in Connecticut. — (*Bull. Torr. bot. club*, March, 1883.) s. w. [785]

Lythraceae. — Koehne concludes the strictly systematic portion of his monograph with the genus *Lagerstroemia*, of twenty-one species, chiefly of central Asia, China, and Japan (two native to Australia, and one in Madeira), and *Lawsonia*, of a single species, the 'Henna' of the orientals, widely cultivated in the tropics, but of uncertain origin. A discussion of the geographical distribution and of the morphology of the order is to follow. — (*Engler's bot. jahrb.*, March, 1883.) s. w. [786]

ZOOLOGY.

Protozoa.

Investigations on certain Protozoa. — Dr. August Gruber, the skilful observer of Protozoa, has published a memoir in which he describes two new salt-water rhizopods, and reports new observations on certain Infusoria, and the conjugation of Actinophrys. The first new rhizopod is named *Pachymyxa hystrix*. It is distinguished especially by an envelope composed of little rodlets, standing perpendicular to the surface. In this envelope are pores through which simple, not branching, lobate pseudopodia can be extended, as in a foraminifer. The animal can slowly alter its form. It is brown in color, and has in its interior numerous bodies which may be small nuclei. In the same aquarium a similar animal was observed, but which had no envelope. Gruber considers this second form as probably the same species in a different condition. The second new species, *Amoeba oblecta*, is very small (0.03–0.04 mm.). It builds itself a granular dome-shaped house. It has no contractile vacuole; but a nucleus may be brought out by reagents. As they move about little, they are usually found in colonies.

In part second (Infusoria) a new species (*S. guttula*) of *Spongomonas* is described. The minute round or oval flagellate animals live each in its tube; but the tubes are all united together to form a hollow sphere. Gruber suggests, that, as they occur in putrid water, they have gathered together around a bubble of oxygen, and so come to form a hollow colony. The genus *Stichotricha* is remarkable among hypotrichous Infusoria for forming a protective covering. Gruber describes several forms, which may be only varieties of *S. socialis*, besides another form, which he names *S. urnula*. It lives in a transparent, membranous, flask-shaped shell, has the characteristic ciliation of the genus, two oval nuclei, to be seen only in stained specimens, but no nucleoli were detected. Over the body are flexible cilia, capable of acting alternately as cilia and pseudopodia. The animals multiply by division; the two daughter-animals living a while in one shell, until one wanders forth, and forms a new shell, usually near by, so that a colony may be thus formed. Gruber also refers Kent's *Chaetospira* and Hudson's *Archimedeia* to *Stichotricha*.

Besides the usual fusion of two or many individual Actinophrys, Gruber has observed the fusion as rather absorption of a small Actinophrys without a nucleus by a big nucleated individual. There is no reason for believing that either form of fusion is concerned with reproduction. Finally the author advances some general considerations to show that the nucleus has no importance for those functions of the cell-body which stand in no direct relation to reproduction; namely, movement, assimilation, excretion, and growth. It may also be without influence on the external form. — (*Zeitschr. wiss. zool.*, xxxviii. 45.) C. S. M. [787]

Mollusks.

Large American pearls.—Some remarkably large pearls have been obtained, during the last fishing-season, at the fishery near La Paz, in the Gulf of California. One found in December,—the largest on record from this region,—weighing 75 carats, sold on the spot for \$14,000, and is considered to be worth much more. Another very perfect one, of 47 carats, is valued at \$5,000; and a third, at \$3,000. It is many years since such good fortune has attended the divers of this region, though the product of pearls of moderate size has been tolerably constant. — (*Mex. financiero*, Jan., 1883.) W. H. D. [788]

Ottawa Unionidae.—The researches of Mr. F. R. Latchford among the fresh-water mollusks of the vicinity of Ottawa have been fruitful of results. In 'Notes on Ottawa Unionidae,' he mentions fourteen species of the genus *Unio*, of which one (*U. borealis* Gray) is new, and apparently valid. There are also three species of *Margaritana*, and ten of *Anodonta*. Previously, only twelve species altogether had been recorded from this vicinity. The paper is full of interesting biographical details in regard to the species enumerated, and their varieties. The author notes the asymmetry of the embryos of *Unio* in *Anodonta fluviatilis*, *Unio luteolus*, and *U. borealis*, and infers it for *Unionidae* in general, though they have been described as perfectly symmetrical. A mite found in the gills of *A. fragilis*, and placed in the hands of Mr. Tyrrell for investigation, is as large as a pellet of buckshot. It appears that the lumbermen on the Chaudière eat these mollusks, and obtain them in an ingenious manner. Birch brushwood, tips down, is attached to the raft so as to drag gently over the bottom when in the shallows. The open bivalves feel the twigs passing over, close the valves on them, and hold fast. At intervals the brush is lifted, and the adhering 'clams' are picked off. — (*Trans. Ott. field nat. club*, no. 3.) W. H. D. [789]

Fossils of the Rizzolo clays.—Seguenza has just issued a brochure in regard to the clay deposits of Rizzolo, province of Syracuse, Sicily, with lists of the fossil mollusks found in them, which comprise two pteropods, fifty-five gasteropods, and sixty-eight lamellibranchs, many of which still live in adjacent waters. The deposit is considered by the author to be quaternary, and derives its interest particularly from the fact, that remains of the living African elephant (*E. africanus* Blum.) have been discovered in it, raising interesting questions as to the former range of that mammal. To the discussion of this branch of the question, and of the identity of the species, the paper is chiefly devoted. — W. H. D. [790]

Myriapods.

Devonian myriapods.—An interesting discovery has been made by B. N. Peach, in the lower old red sandstone of Scotland, of myriapods in rocks older than the carboniferous series, the lowest that have before this yielded them. Two species are described and excellently figured, one of which has long been known, and supposed to be a Crustacean, having been described by Page under the name of *Kampecaris forarensis*. They are of small size, and differ considerably from each other. *Kampecaris* is cylindrical, scarcely tapers at the head end, and is composed of numerous sub-equal alternately larger and smaller somites, each bearing a pair of legs. *Archidesmus* is depressed, fusiform, with alternately very unequally larger and smaller somites, each bearing a pair of 'six or seven jointed' spinous legs (none are shown in the figures attached to the smaller, intercalary

somites). It will be seen that they differ considerably from the known carboniferous myriapods. — (*Proc. roy. phys. soc. Edinb.*, vii. 177, pl.) [791]

Dermal appendages of *Polyxenus*.—The different forms of hairs in *P. fascicularis* are described and figured by Scudder; those upon the body-joints, *a*, *b*, varying from club-shaped spines, furnished with several rows of flattened teeth, to sabre-shaped spines, serrate on the convex side. The posterior extremity of the body is provided with a pair of cylindrical fascicles, resembling those of the larva of *Anthrenus*, but composed of very curiously-formed bristles, *c*, shaped like an elongated fish-hook, the shaft gently curved, and the tip recurved and apically barbed. The shaft is armed with delicate spinules, and the crook furnished on the concave side with a few spatulate, drooping appendages. These appendages are also figured, rather rudely, by Packard in the *Amer. nat.* for March. — (*Proc. Bost. soc. nat. hist.*, xxii. 67.) [792]

Insects.

The American species of swallow-tail butterflies.—As the result of the study of a large series of forms partly collected by himself in Washington Territory east of the Cascade Mountains,—a hitherto unexplored region,—Dr. Hagen concludes that *P. Zolicaoon*, *oregonius*, and *Alaska*, are all specifically inseparable from the old-world *P. Machaon*, the range of variation in which he also discusses. He also unites *P. Rutulus* and *Eurymedon*, and considers them a western form of *P. Turnus*. — (*Papilio*, ii. 149.) W. H. Edwards vigorously combats this view, so far as the first series is concerned (*Ibid.*, iii. 45, pl.). [793]

Wisconsin Lepidoptera.—The geological survey publishes a catalogue of Wisconsin Lepidoptera by Hoy, long known as an enthusiastic collector in that state. The title is a misnomer; for, besides the butterflies (99 sp.) and hawk-moths (52 sp.), the author only enumerates the Bombycidae (75 sp.) and Geometridae (109 sp.); the Noctuidae (388 sp.) being oddly placed in a separate list, and other groups wholly omitted. Not the slightest notes are appended, except in the first two groups, where an indication of the abundance of the species, in a single word, is usually given. With the exception of an occasional straggler from the south, the list contains nothing noteworthy. — (*Rep. geol. surv. Wisc.*, i.) [794]

Geographical origin of North-American Sphingidae.—Three proximate sources are found by Grote for our Sphingid fauna, which consists of about 93 species. Omitting Sphinx, which the author claims to belong to an older period of separation, 10 genera (32 sp.) are considered as descendants of a circumpolar pre-glacial fauna; 11 genera (26 sp.), accessions from the tropics; and 14 genera (20 sp.), of North-American origin peculiar to the continent. All the species of a genus (excl. Sphinx) are thus seen to have a common geographic origin. "The decisive element in our fauna does not come from the old world." — (*Amer. journ. sc.*, March.) [795]

VERTEBRATES.

(Physiology.)

Influence of the centre of deglutition on that of respiration.—Steiner calls attention to some generally overlooked researches which show that an act of swallowing is usually accompanied by a more or less marked respiration, and himself adds

some new facts. He finds, that, on stimulation of the central end of the superior laryngeal nerve in the rabbit, every resulting swallowing movement is accompanied by more or less marked inspiration and expiration, and that the respiratory muscle concerned is the diaphragm. He concludes that the two centres are so united by commissural fibres that every stimulation of the deglutition centre is associated with excitation of the respiratory. — (*Du Bois' archive*, 1883, 57.) H. N. M. [796]

Digestion with exclusion of the stomach. — Working on dogs, Ogata finds, that when food is directly placed in the duodenum, and all gastric (also salivary) secretion is kept out of the intestines, the animal can still digest many things well, so as to maintain its weight, and pass normal faeces. Certain foods, however (as connective tissue), need the preparatory action of the gastric acid in order that they may undergo normal digestion; others need a change in their surface, or decomposition into small fragments such as usually occurs in the stomach, in order that they may lie long enough in the intestine to be thoroughly dissolved. The stomach, therefore, gives the dog opportunity to use a wider range of substances for the satisfaction of its nutritive wants. The transformation of proteids into urea occurs more uniformly when the stomach is allowed to act. — (*Du Bois' archive*, 1883, 89.) H. N. M. [797]

Influence of carbon-monoxide poisoning on trypsin. — Podolinski has found that the transformation of pancreatic trypsinogen into trypsin is associated with the assumption of oxygen. Herzen finds that the pancreatic infusion of dogs killed by carbon-monoxide gas, which infusion, under normal circumstances, would have contained much trypsin, possesses hardly any. He concludes that either the absence of oxygen from the blood has led to a reconversion of trypsin into trypsinogen, or that trypsin forms with carbon monoxide a compound which is not proteolytic. — (*Pflüg. archive*, xxx. 308.) H. N. M. [798]

Reptiles.

The physiological action of Heloderma poison. — That this lizard, the Gila monster (*Heloderma suspectum*), is venomous, has been often asserted and as often denied. Weir Mitchell and Reichert find that its mouth-liquids are highly poisonous, killing frogs, pigeons, and rabbits in a few minutes. This establishes it as the only venomous lizard known. What is of even more interest, perhaps, is the fact that the physiological action of the poison is quite different from that of snake-poison: the latter kills essentially by paralyzing the respiratory centre, the former by paralyzing the heart. *Heloderma* venom causes no local injury when injected subcutaneously; and arrests the heart in diastole, from which condition the organ slowly passes into a contracted state. The heart-muscle entirely loses its irritability when the organ ceases to beat, and when other muscles and the nerves still readily respond to stimulation. The spinal cord is paralyzed. — (*Medical news*, Feb. 10.) H. N. M. [799]

Relations of the Mosasauridae. — M. Dollo, assistant naturalist to the royal natural history museum of Brussels, separates the *Mosasaurus Maximiliani* of Goldfuss generically from the *M. Camperi*, under the designation *Pterycollasaurus*. In this new genus the pterygoids are united along two-thirds of their entire length, especially in the dentary portion, whereas in the typical *Mosasaurus* they are entirely separate. This last is also the case with the American genera *Tylosaurus*, *Lestosaurus*, *Holosaurus*. In another new genus now indicated, *Plioplatecarpus*

(*P. Marshii*), which appears to be closely related to *Leiodon* and *Lestosaurus*, and of which fragments are contained in the museum of Brussels, the author indicates the presence of a sacrum composed of two united vertebrae having the same disposition as the similar parts in the pelvic girdle in the iguana and monitor. From the presence of this sacrum, M. Dollo concludes, in opposition to the views of Prof. Cope (who, under the name of the *Pythonomorpha*, approximates these animals to the serpents), that the mosasauroids were true lacertilians, and that they held a place among these similar to that occupied by the pinnipeds among the carnivora. — (*Bull. mus. royal Belg.*, i. 55.) A. H. [800]

Mammals.

The bunotherian mammals. — Professor E. D. Cope defines the Bunotheria as resembling in most technical characters the Edentata and the Rodentia. Their enamel-covered teeth, however, separate them from the former, while the articulation of the lower jaw is different from that found in the latter. This is a transverse ginglymus with a posterior process in the Bunotheria, as distinguished from the longitudinal groove permitting antero-posterior motion of the Rodentia.

After dwelling on the characters of the related forms, and pointing out the inconsistencies of the present classification, he defined the five suborders as follows:—

- I. Incisor teeth growing from persistent pulps.
Canines also growing from long persistent pulps, agreeing with external incisors in having molariform crowns I. Taeniodonta.
Canines rudimental or wanting; hallux not opposable II. Tillodontia.
Canines none; hallux opposable.

- III. Daubentonioidea.
II. Incisors not growing from persistent pulps.
Superior true molars quadrituberculate; hallux opposable IV. Prosimiæ.
Superior true molars quadrituberculate; hallux not opposable V. Insectivora.
Superior true molars trituberculate; hallux not opposable VI. Creodonta.

It was possible that the group which he had called the Mesodonta may yet be distinguished from the Insectivora by characters now unknown. But he could not admit any affinity between this group and any form of pachyderms, as suggested by Filhol, or of Suillines as believed by Lyddeker, as such suppositions are directly opposed to what we know of the phylogeny of the mammalia. These views are apparently suggested by the bunodont type of teeth found in various Mesodonta; but that character gives little ground for systematic determination among Eocene mammalia, and has deceived paleontologists from the days of Cuvier to the present time. The only connecting-point where there may be a doubt as to the ungulate or unguculate type of a mammal is the family Periptychidae of the suborder Condylarthra. The suborder Hyracoidea may furnish another index of convergence.

He had at one time called this order by the name Insectivora, a course which some zoologists may prefer. A name, however, should as nearly as possible adhere to a group to which it was first applied, and whose definition has become currently associated with it. Such an application is a material aid to the memory. There are various precedents for the adoption of a new general term for a group composed of subordinate divisions which have themselves already received names. — (*Acad. nat. sc. Philad.*; meeting April 3.) [801]

ANTHROPOLOGY.

Are the stone graves modern?—Throughout Kentucky, Tennessee, and other sections draining into the Ohio, the aborigines, at some former period, buried their dead in stone boxes or cists, made of thin slabs of limestone, and other rock. There are those who maintain that this form of burial was practised by a highly cultured race of people, who passed away before our modern Indians set foot in that country. Dr. Charles Rau, in a paper before the American association at Montreal, gave an account of graves opened by Dr. Wislizenus, in Randolph County, Ill., containing both of Dr. Morton's types of North-Americans,—the Toltec, and the true American. Dr. H. Shoemaker opened a stone grave, in Monroe County, Ill., which contained the remains of a Kickapoo Indian. Dr. Rau concludes that the stone graves owe their origin to the race inhabiting within historic times, or even earlier, the district where they are found. — (*Amer. nat.*, Feb.) J. W. P. [802]

Cup-shaped sculpture.—One of the enigmas of the stone age is the occurrence of cup-shaped cuttings, singly or in groups, from the size of a half-bullet upwards, upon small, movable bowlders, as well as upon large stationary rocks. Dr. Rau, in his paper on "Cup-shaped and other lapidarian sculpture in the old world and in America," has ransacked the literature of Great Britain, France, Switzerland, Germany, Scandinavia, and India, for old-world examples. Many of these are very elaborately carved and encircled, giving evidence of connection with ancient mystic rites. The American specimens are much ruder; and the cautious author is disinclined to attribute to them the same mystery that hangs over those in the eastern world. — (*Contr. N. A. ethnol.*, v.) O. T. M. [803]

EGYPTOLOGY.

The Fayoum.—The good work done by Mr. Cope Whitehouse (*Rev. archéol.*, Juin, 1882; *Bull. Amer. geogr. soc.*, 1882, No. 2) on the boundaries of the ancient Lake Moeris is to be supplemented by further researches into the formation of the pyramids, and the possibilities of irrigation in the Fayoum. Mr. Whitehouse is now in Cairo; and, with the aid of government surveyors, he hopes to verify his theories, which have been somewhat misunderstood. — (*Athenaeum*, March 24.) H. O. [804]

Ancient Egyptian economy.—Broken crockery was not entirely lost to the Egyptians, for he saved the pieces to have inscribed on them the tax-gatherer's

receipts. Immense numbers of these inscribed fragments have been found; and, from the collection in the British museum, Dr. Birch has given a series of translations, showing the tax in Egypt under the early Caesars. — (*Proc. soc. bibl. arch.*, March 6.) H. O. [805]

New discoveries.—This year promises large results in new discoveries. The director of the Boolak museum, Maspero, though with scanty means, has made great progress in new work. He has obtained a royal sarcophagus of the twenty-fifth dynasty, and several valuable mummies. He has also found an Egyptian crypt containing an early Coptic church, with all its ecclesiastical furniture intact. — (*Academy*, March 24.) H. O. [806]

Work in progress.—The mural decorations of the tomb of Seti I. (Belzoni's tomb) at Bab-el-Molook are now being copied by Lefébure, Loret, and Bourgoin, members of the French college of archeology at Cairo. The temple of Luxor is to be excavated in the autumn. Maspero is to resume the excavation of the pyramid at Lisht in May. — (*Academy*, March 24.) H. O. [807]

EARLY INSTITUTIONS.

Manumissions at four roads.—F. E. Warren finds proof, in the Leofric missal, — a X.-XI. cent. MS. preserved at the Bodleian in Oxford, — of the existence, in England, of the custom of manumitting slaves at places where four roads meet (*on feower wegas*). The passage is given in full from the MS. — (*Rev. cel.*, Jan., 1882. Cf. *Rep. Devonsh. ass. adv. soc.*, viii. 417, 1876.) D. W. R. [808]

Ostracism.—M. Houssaye gives a brief history of ostracism as it obtained in Athens and other Greek cities and colonies, *à propos* of the effort to introduce something like it in France. — (*Rev. deux mondes*, 15 Fév.) D. W. R. [809]

Moslem property-law.—Baron von Tornauf writes at length upon this subject. It has been generally maintained, in regard to the land in Moslem countries, that it has been the common property of the people (*der moslemischen religionsgenossenschaft*); that the individual has had no real right of property in it, only a usufruct (*nutzungsrecht*). The writer attempts to show, that according to the Koran, according to tradition, and according to the law-books (*scheriätbüchern*), private property in land, in the fullest sense of the term (*volles eisenhumsrecht auf grund und boden*), existed everywhere. The writer gives a list of sources (34 titles). — (*Zeitschr. deutsch. morgenl. gesellsch.*, xxxvi. ii.) D. W. R. [810]

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

PUBLIC AND PRIVATE INSTITUTIONS.

Peabody museum of American archaeology, Cambridge, Mass.

The ancient cemetery at Madisonville, O.—In his recent explorations in connection with Dr. G. L. Metz, Mr. Putnam made extensive researches at this place. Near the cemetery are several earth-circles, from forty-three to fifty-eight feet in diameter. Trenches run through four of them revealed in the centre of two, on the clay bottom, beds of ashes in which were potsherds, flint-flakes, and burnt bones, with a perforated clam-shell. In the trench, on the clay, there were found a rudely chipped stone hoe, a rude stone axe with a groove, a split pebble, a fragment of a stone gorget, worked antler-tips, and several rude

arrow-points. The results of the examination of these circles proved them to be the sites of habitations, over which from one to two feet of leaf-mould has formed since the central fires were deserted and the circular structures fell from decay. The few things found within the circles, and the abundance of household utensils, implements, and refuse, found in the ash-pits, suggest the possibility, that on special occasions all the articles in the house, with ornaments, implements, and other personal objects, were partly destroyed by fire, and the remnants, being gathered up with the ashes, were deposited in a pit dug for the purpose; while the great number of broken bones of various animals, mixed with the ashes, indicates that at such times feasts were held. Such a custom would

account for the character of the contents of the pits, and the great number of the pits would indicate a long-continued occupation of the village.

Houghton Farm, Mountainville, N.Y.

Soil-temperatures. — During the past year observations upon soil-temperature were carried on by means of mercurial thermometers of special form, adjusted to slow action. It was sought, however, to overcome the inconveniences of their use, since they require to be drawn at each reading. Recourse was therefore had to an electrical thermometer, which is now in use, supplementary to, and in extension of, the mercurial thermometers, which will continue to be employed. The thermo-apparatus is really one of Becquerel's electrical thermometers, though some slight modifications have been introduced in the method of balancing the current. The apparatus, as now in use, may be described as follows:—

Couples are formed by soldering copper wires to the iron line-wire at such intervals as are required. These are then enclosed in an hermetically-sealed tube, filled with perfectly dry sand, free from iron, and brought to a common level above ground, where they are firmly connected with binding-screws. The cap carrying the binding-screws is of wood, three inches greater in diameter than the tube, and painted white to prevent any possibility of radiation from the latter. The tube is then planted in the soil, wherever needed, at the required depth, and such connection made with the office as may be desired. A duplicate set of couples, exactly like those in the tube, is provided in case a test is necessary. The wires are of the same size all the way through, and are No. 8 copper, insulated, and No. 8 telegraph wire. In the office a second couple of the copper and iron wires is carried down into a well of wood, having a diameter of one inch and a quarter inside, with walls of two inches thickness. This is provided with a stop-cock and overflow attachment. From a convenient support, immediately above the mouth of the well, depend a thermometer, the bulb of which is brought to the same level with the couple, and two glass tubes, which supply hot and cold water from reservoirs placed upon a shelf at convenient distance. A switch-board is introduced into the line of copper wire, while a very sensitive galvanometer is introduced into the line of iron wire. A deflection of the galvanometer-needle to the right or left is neutralized by balancing the current with the hot or cold water, as the case may require, and readings taken when the needle comes to zero. I believe this is the first attempt in this country to apply this apparatus to so extended use.

So far as observations have gone, the advantages which this instrument possesses over mercurial thermometers seem to be: 1. Greater accuracy; 2. Expedition; 3. Greater durability; 4. Personal comfort, and absence of those annoyances inseparably connected with an instrument which must be drawn from the ground in all kinds of weather, and at all times of day and night.

NOTES AND NEWS.

Since the leading article of this issue was ready for the press, the circular issued by the council of the British association to its members has come to hand; and from this it would appear that the meeting in Montreal is regarded as substantially determined on, and that the time fixed for it will probably

be the last week of August, or the first week of September, 1884.

—The director of the Illinois state laboratory of natural history, Dr. S. A. Forbes, to whose office that of the state entomologist was recently attached, has made a special report to the state board of education, in which he states that the field-work of the botanical and zoölogical survey of Illinois is substantially done, and recommends the immediate preparation and publication of systematic reports on the natural history of the state, having special reference to economic ends. He estimates four volumes as necessary to cover the zoölogy (exclusive of injurious insects) and cryptogamic botany. No additional appropriations appear to be asked for, but rather the diversion of the ordinary funds from field-work to publication. The board of education, which controls the laboratory in Illinois, was so appreciative of the excellent work which Dr. Forbes has been doing as to vote him \$500 more than he asked. We wish Dr. Forbes success in his new departure, and shall anticipate volumes of unusual interest.

—Professor Weyenberg of Cordoba, who has written upon many branches of zoölogy since he has been in the Argentine Republic, is now engaged, also, in publishing a manual of histology in Spanish, under the title 'Principios histológicos.'

—Mr. Dörflinger, of the Milwaukee natural history society, has recently made a minute examination of the methods of installation and details of administration in the National museum, with a view of introducing the best features into the new museum to be established by the city of Milwaukee, upon the basis of the collections of the society. Mr. Dörflinger will visit the natural history museums in the larger eastern cities before returning to the west.

—Major-Gen. Pitt-Rivers, of the English army, has spent the most of his leisure in collecting the most valuable anthropological museum in the world, from one point of view. Discarding areas, races, and epochs, his aim has been to collect from all parts of the world the products and implements of human industry in such numbers and variety as to illustrate the evolution of art. Having offered this splendid collection to the university of Oxford on condition that they would erect a building adequate to contain and to display it properly, Gen. Pitt-Rivers has the satisfaction of knowing that the university authorities will comply with his request. The delegates of the museum have elected Dr. E. B. Tylor to be keeper of the collection.

—Under the title "Mittheilungen über die arbeiten der moor-versuchs-station in Bremen in den jahren 1877-1882 (von Dr. M. Fleischer)," the last number of the *Landwirthschaftliche jahrbücher* (xii., no. 192) contains an account of the founding of this station, which is devoted to the investigation of questions connected with the reclamation and cultivation

of the extensive moors of north-western Germany, and a summary of its work up to the present time. This is followed by five papers, in which some of its investigations are recounted in detail. The subjects of these papers are: a geographical description of the moors of north-western Germany and the Netherlands (by Lalfeld), the Kehdinger moor (by Virchow), the behavior of insoluble phosphates in moor-soils (by Fleischer), the influence of certain salts on the action of peat upon phosphates (by Kissling), materials for manuring and improving moors (by Fleischer). This is the first detailed account of the work of the station which has appeared.

—The *Franklin democrat* of Brookville, Ind., prints, March 1, an account of the work of the Brookville society of natural history for the year ending February, 1883, by the secretary, Amos W. Butler. The active members increased in that period from fifteen to twenty-six.

—The building of the ice-palace at Montreal this winter has recalled to notice (*Symon's monthly meteorological journal*, February) an account, by Prof. G. W. Kraft, of that built at St. Petersburg in 1740. The most remarkable part of Professor Kraft's statement is, that an ice-cannon was made, and that a bullet fired from it, with a charge of a quarter of a pound of powder, penetrated a plank two inches thick at a distance of fifty paces.

—An excellent *résumé* of the present condition of our knowledge of fossil insects, extending over more than thirty pages, is given by Charles Maurice in the *Annales de la Société géologique du Nord.*, vol. ix.

—The *Amateur naturalist* is the title of a miniature paper of four pages, published monthly at Germantown, Philadelphia, entirely by boys. Its fifth and sixth numbers contain a brief abstract of a lecture on the cobblestone, given by Dr. H. Carvill Lewis before the Leidy association on Dec. 6.

—Mr. J. H. Barth of Leipzig will issue an "*Internationale zeitschrift für allgemeine sprachwissenschaft*" in semi-annual parts, under the editorial care of F. Techmer. The staff includes such names as Lucien Adam, C. von der Gabelentz, A. S. Gatschet, R. Lepsius, F. A. March, Frederick Müller, Max Müller, G. Oppert, F. Pott, Leon de Rosny, A. H. Sayce, H. Steinthal, Jules Vinson, and William Dwight Whitney. The review is to be organ of no school, but will aim to foster real progress in every line of linguistic research. The subject will be presented in three aspects,—the anthropological, the psychological, and the historical. Under the first the whole range of ancillary sciences will be brought under contribution; such as the physiology and pathology of the vocal organs and the ear; the optical phenomena of writing, mimicry, gestures, and writing for the blind; and the relationship existing between speech and its transcription. Upon the psychological side will fall all questions of the rela-

tion of articulation, vocal sounds, roots, words, and syntax, to the science of mind. Finally, the history of philology will include both the phylogenetic development of language as a whole, and the ontological development of speech in each individual from infancy to maturity. If the weight of great names and a great undertaking will insure success, no doubt the *Zeitschrift* will become a permanent part of our linguistic literature.

—At a recent meeting of the Philadelphia academy of natural sciences, Prof. H. C. Lewis showed a supposed stone implement recently dug up in that city. It is described as an oblong rectangle in shape, sixteen and a half inches long, nearly four inches wide, and in thickness varying from a half-inch at the edge to one and a half inches at the centre. It is ground to a smooth cutting-edge at the two extremities. It is rectangular in section, the sides forming right angles with the faces. The sides are parallel with each other; but the faces are undulating surfaces, on one of which is a prominent longitudinal ridge an inch and a half in width. Each end of the implement appears to have been smoothly ground to form a square, even cutting-edge, an equal amount of grinding having been done on either side. The implement is as unusual in shape as it is in size. It is double the length of ordinary celts, and was possibly a lap-stone of some kind. The implement, if such it should prove, would be the first that has been found in the Philadelphia gravel, and would be of great interest in its bearing upon the antiquity of man on the Delaware.

—Dr. D. W. Prentiss has been invited to deliver a course of lectures in connection with the department of materia medica of the National museum. The course will consist of eight lectures, and will be illustrated by specimens and other material from the collections.

—At a meeting of the Society of arts of the Massachusetts institute of technology, April 12, Mr. A. F. Hill presented a paper on the Crystallization of iron and steel, illustrated by specimens and photographs.

—At the meeting of the Biological society of Washington, April 13, the following communications were made: Prof. L. F. Ward, Hybrid oaks of the District of Columbia; Mr. B. F. Johnson, Observations on the climbing of snakes; Prof. C. V. Riley, Remarks on the bag-worm (*Thyridopteryx ephemeraeformis*); Mr. F. W. True, The tape-worm and other parasites in the eggs of the domestic fowl; Dr. Thomas Taylor, Living parasitic mites in the lungs, cavities, and tissue of domestic fowl; Mr. N. P. Scudder, The muskrat (*Fiber zibethicus*) in captivity.

—Prof. A. Hall, on taking the chair of the mathematical section of the Washington philosophical society, April 11, read a short address on the practical value of the higher mathematics. Mr. C. H. Kum-

mell gave an investigation of "Alignment curves on any surface, with special application to the ellipsoid."

—Mr. A. W. Cramer reports the capture of two specimens of *Catocala unijuga* Walk., last autumn, in mid-ocean off the coast of Newfoundland, on board a steamer bound for Europe.

—Prof. G. F. Wright, in the *Cleveland leader* of April 9, gives an account of his successful search for the continuation of the great terminal moraine across the Ohio River in Kentucky. The marks of glaciation disappeared suddenly, "almost exactly upon the line between Campbell and Pendleton counties."

—Prof. H. Carvill Lewis has reprinted his lecture before the Franklin institute on The great ice age in Pennsylvania, with a shaded map indicating the southern limit of the glaciated area from the Atlantic to the eastern border of Ohio.

—At the recent yearly meeting of the Brookville (Ind.) society of natural history, the following officers were elected: Rev. D. R. Moore, president; D. W. McKee, vice-president; Amos W. Butler, secretary; Edgar R. Quick, corresponding secretary.

—G. Pouchet of the Museum of natural history of Paris is soon to visit the Azores on a scientific excursion. The municipal council of Paris has voted eight thousand francs towards his expenses.

—P. Sacconi has established his station at Harrar, Somali-land, and has despatched two caravans to the coast. The town is a miserable place, and hyenas prowl about its streets at night. Sacconi plans to go on to the unvisited district of the Ogadin Somali.

—Consul O'Neill has received a grant from the Royal geographical society to aid his explorations from Mozambique toward the snowy mountains, reported on his last expedition. He will go up the Shire River, and return overland north-eastward to the coast.

—The Bengal administration report for 1881–82 states that the Calcutta zoological gardens are in a very flourishing condition. Two new buildings have been constructed through the generosity of Messrs. Ezra and Gubhoy, citizens of Calcutta. The number of visitors for the year was 120,749, being an average of 331 daily. The gardens are open upon Sunday.

—M. Fau intends soon to set out from Wargla, Algeria, for the Tuareg country, Hausa, and Timbuctu, following the line of Flatters's disastrous expedition.

—According to recent calculations by A. J. Skene, surveyor-general of Victoria, the area of Australia, as closely as it can now be determined, is 2,944,019 $\square$ miles. This is nearly 30,000 less than the previous official estimates. The population according to the census of 1881 was 2,144,550, — an increase of 36.92 % in ten years.

—The name of Buckland revives the days of childhood and geology, as a chiming bell in a foreign land recalls to the traveller memories of home. The U. S. bureau of ethnology has received from Miss A. W.

Buckland a bound volume containing her collected essays upon various subjects relating to the natural history of man, embracing: The first metallurgists (1875); The origin and development of man (1875); Early phases of civilization (1876); Primitive agriculture (1877); Stimulants among savages and among the ancients (1879); Mythological birds (1879); Cornish and prehistoric Irish monuments (1879); Rhabdomancy and belomancy (1879); Surgery and superstition in neolithic times (1881); Our anthropological museum (1877). Other essays are bound in the volume, but they are not purely anthropological.

—Dr. Koner's list of publications of all kinds referring to geography for the year ending November, 1882, fills one hundred and forty-four pages in the recent number of the *Zeitschr. f. erdkunde* of Berlin. Of these, the United States require only five; while Africa has eighteen, Asia twenty, and Europe thirty-five.

—At a recent meeting of the Northumberland and Durham medical society, several forms of electric-light apparatus, devised by Mr. J. B. Payne for the illumination of internal cavities, were shown. A Swan lamp not larger than a bean is used. A battery of two or three Grove cells is sufficient to render the carbon filament incandescent.

—Prof. H. W. Wiley, former occupant of the chair of chemistry in Purdue university, Lafayette, Ind., has just been appointed (April 9) to the position of chief chemist of the U. S. department of agriculture. Professor Wiley is a native of Indiana, and a graduate of Harvard. His standing as a chemist is high among scientific men; and his paper on the relation of science to the industries and arts, read last January at one of the conventions held in the department building, attracted much deserved attention. Mr. Collier, whom he supersedes, was also an excellent chemist; and his abrupt dismissal by the commissioner of agriculture, after five years of service, and without justifiable reason as far as we can learn, merits the severest condemnation.

—The second biennial report of the director of the North-Carolina agricultural experiment station contains an outline of the work performed at the station during 1881 and 1882, a plan and description of the new apartments recently occupied by it in the building of the department of agriculture at Raleigh, a statement of some changes in the law establishing the station, and some account of the growth and present extent of the fertilizer-trade in the state.

The station has also published, in the form of bulletins, some analyses and investigations of horn, leather, and wool-waste, and the fertilizers containing them; of finely-ground phosphates, or 'floats;' and of kainite; as well as a list of analyses and valuations of all fertilizers examined up to March 1, 1883.

The finely-ground phosphates are the product of the Duc mill, working chiefly on South Carolina phos-

phates. The size of their particles was measured microscopically; and they were also treated with neutral ammonium-citrate solution, in the manner customary in fertilizer analyses. From fifteen to twenty-five per cent of the total phosphoric acid proved to be soluble in this reagent, but no very marked increase of solubility was observed as the result of very fine grinding.

The bulletin on kainite consists chiefly of a summary of German and American experience in its use, going to show, that, with even moderate caution, it may be used with as much safety and advantage as the refined potash salts now so largely employed.

—The last of the Washington free scientific lectures was delivered by Dr. Robert Fletcher on March 31. The weather being unusually bad, the audience was small. As a whole, the lectures have been remarkably well attended; and the interest displayed will doubtless encourage the societies to undertake another course next year. It is a prevailing opinion, that groups of three or four lectures upon the same subject, delivered in the evening, would meet the needs of the people better than the schedules hitherto provided.

—A new magnetic and meteorological observatory is soon to be established at Hong Kong; and Dr. W. Doberck goes from Col. Cooper's observatory, Markru, Ireland, as its director.

—Among the good works performed by the Musée Guimet appears the *Revue de l'histoire des religions*, published under the direction of M. Maurice Vernes, aided by distinguished collaborators in various countries. The journal has reached its sixth volume, and shows no signs of decay. The last number received contains papers on the following subjects: Islamism as a universal religion, by A. Kuenen; Aeneas before the time of Virgil, by J. A. Hild; The religions of non-civilized peoples, by A. Reville; The legend of Alexander among the Mussulmans, by M. Decourdemanche; and A course of instruction in the history of religion, by Paul Bert.

—Henry Y. L. Brown of Sydney, Cape Breton, has been appointed director of the geological survey of South Australia. Mr. Brown has a long acquaintance with the geology of Australia, having already been government geologist of western Australia, and assistant on the geological survey of Victoria and New South Wales. Besides, he was assistant of Mr. Selwyn in the geological survey of Canada during the years 1874-75.

—We regret to learn the death of George W. Stow, director of the geological survey of the Orange Free State, South Africa. Mr. Stow died at the end of last year, at a coal-mine near Heilbron, where he had discovered an important coal-basin. Heilbron is near Smithfield, Orange River. No one has done so much towards elucidating the geology of southern Africa as Mr. Stow. His 'Geological notes upon

Griqualand West,' and his 'Coal and iron in South Africa' are both standard works.

—The third German geographers' congress, assembled at Frankfurt-a.-M. from March 29 to April 8, listened to addresses by Wissmann, on his journey across Africa; Ratzel, on polar exploration; Buchner, on the ethnography of south-western Africa; Pechuël-Lösche, on the lower course of the Kongo; Günther, on the latest studies of the earth's form; Toulou, on the geological exploration of the Balkan peninsula; and Penck, on the influence of climate on the form of the earth's surface; besides several others, chiefly devoted to methods of geographic instruction. In connection with the meeting, there was a geographic exhibition, of which the catalogue contains 1,100 numbers, and fills 92 pages. Different styles of mapping were very fully illustrated; and there was a good representation of atlases, globes, wall-charts, and geographic works.

—Dr. B. A. Gould of Cordoba, Argentine Republic, now on a visit to this country, exhibited to the Royal astronomical society, March 9, a number of photographs of star-clusters in the southern heavens. There were, beside these clusters, four stars suspected to have an appreciable annual parallax. Dr. Gould stated that the observations for his zone-catalogue (105,000 in number) were completed in 1875; but the subsequent reductions had given a great deal of trouble, as his staff was limited, and he had been obliged to enlist into the service everybody he could find who had had sufficient education to be of use. "I have had bakers, shoemakers, printers, carpenters, bricklayers, and school-masters, sailors and engine-drivers. Of course, the degree of accuracy was sometimes questionable, and I have been obliged to do every thing in duplicate." Dr. Gould hopes that in a year's time the zone-catalogue, in two volumes, with 74,600 stars, will be published. The zones extend only from the tropic to within ten degrees of the south pole. Dr. Gould is also engaged upon a general catalogue of about 34,000 stars, their positions being determined with the highest degree of accuracy. This catalogue includes every part of the southern hemisphere; and the work is so far advanced that eighteen months more will suffice to complete it.

—An examination of the Waterville meteorite of 1826 shows, according to Dr. M. E. Wadsworth, that it is a slag that had long lain partly buried in sandy soil, and could not have been, as claimed, a freshly detached meteorite.

—The philosophical society of Washington, at its meeting held April 21, was addressed by Capt. William H. Dall, on Glaciation in Alaska, and by Professor Franklin B. Hough, on the Cultivation of the Eucalyptus on the Roman campaign.

—We are glad to announce that the United States is at last represented in the international zoological station at Naples. Thanks to the liberality and

wisdom of President Carter and the board of trustees, Williams College has secured from Dr. Anton Döhrn the right to a table in the Naples station. It is intended to make this in reality an American table; it being open to any original worker from the United States who has received his appointment from the authorities of Williams College. The only agreement necessary in connection with an appointment is, that the appointee, on his return to America, deliver a brief course of lectures at Williams, by which the college may gain some of the advantages which have been afforded the appointee at Naples. The name of each naturalist who lectures at the college will appear in the catalogue as lecturer on the staff of instruction.

Dr. Edmund B. Wilson, Fellow by courtesy of the Johns Hopkins University, is the first and present appointee to the position.

—Mr. Common of Ealing, Eng., presented to the Royal astronomical society, at its meeting March 9, a Woodburytype enlargement of a photograph of the nebula of Orion, taken Jan. 30, 1883, with his great three-foot reflector, the exposure being thirty-seven minutes long. He considered that it showed a marked advance on previous photographs. Some of the finer details were lost in the enlargement, yet this showed several features not rendered in any drawing. Mr. Common called attention to several differences between the photographs and the drawings of Lord Rosse.

RECENT BOOKS AND PAMPHLETS.

Continuations and brief papers extracted from serial literature without repagination are not included in this list. Exceptions are made for annual reports of American institutions, newly established periodicals, and memoirs of considerable extent.

Babut du Mares. Le sewage, son utilisation et son épuration. Bruxelles, *Office de Publicité*, 1883. 260 p., 1 pl. 8°.

Balfour, F. M. Traité d'embryologie et d'organogénie comparées. Traduit par H. A. Robin. T. I.: Histoire de l'œuf; embryologie des invertébrés. Paris, *Baillière*, 1883. 23+567 p., illustr. 8°.

Barratt, A. Physical metempsychic. London, *Williams*, 1883. 8°.

Bertillon, A. Ethnographie moderne. Paris, *Masson*, 1883. 8+312 p., illustr. 8°.

Burnham, S. M. History and uses of limestones and marbles; with 48 chromo-lithograph illustrations of antique and modern marbles. Boston, *S. E. Cassino & Co.*, 1883. 410 p. 8°.

Clark, John S. Industrial education a necessary part of public education. (A paper read before the American institute of instruction, Saratoga, July 13, 1882.) Boston, *The Prang educational company*, 1883. 47 p. 8°.

Czyszkowski, S. Exploration géologique et industrielle des régions ferrifères de l'île d'Elbe. Alais, *imp. Martin*, 1882. 87 p. 8°.

Delboeuf, J. Questions de philosophie et de science. Éléments de psychophysique générale spéciale. Liège, *Desoer*, 1883. 256 p. 12°.

Detmer, W. Lehrbuch der pflanzen-physiologie. Breslau, 1883. 400 p. 8°.

Dewar, D. Weather forecasts, air and tidal currents, and dates of storms for 1883. London, 1883. 8°.

Engelmann, Th. W. The physiology of protoplasmic motion. Translated by Charles S. Dolley. Rochester, *Davis & Leyden*, n.d. 40 p. 8°.

Ennis, Jacob. Two great works to be done on our sidereal system. Washington, *Judd & Detweiler*, 1883. 12 p. 8°.

Gestro, R. Manuale del preparatore ed imbalsamatore. Milano, 1883. 118 p. 16°.

Hauck, W. Ph. Die galvanischen batterien mit besonderer rücksicht auf ihre construction u. ihre mannigfaltigen anwendungen in der praxis. Wien, 1883. 256 p., illustr. 8°.

Heidorn, D. Karte der im mittleren Europa mit blossen augen sichtbaren sterne, auf das mittl. aequ. 1870 berechnet. Göttingen, 1883. f°.

Hutton, F. W. Catalogue of the New Zealand Diptera, Orthoptera, Hymenoptera; w. descriptions of the species. New Zealand, *Wellington*, 1881. 132 p. 8°.

Kroman, K. Vor naturerkiendelse. Bidrag til en matematikens og fysikens teori. Kjøbenhavn, 1883. 316 p. 8°.

Lecoute, J. L., and Horn, G. H. Classification of the Coleoptera of North America. Washington, *Smithsonian Institution*, 1883. (Smithsonian misc. coll.) 38+567 p. 8°.

Ledger, E. The Sun; its planets and their satellites. New York, 1883. 12°.

Lefebvre, B. Les passages de Venus sur le disque solaire. Étude historique suivie d'un appendice sur les observations du 6 décembre, 1882, et du récit des expéditions belges. Louvain, *Peters*, 1883. 70 p. 8°.

Lelontre, G. Recherches expérimentales et analytiques sur les machines à vapeur. Détermination de l'eau entraînée par une méthode thermométrique. Nancy, *Berger-Levrault*, 1883. 63 p. 8°.

Malapert, E. Notes sur le magnétisme et sur la compensation des compos. Nancy, *Berger-Levrault*, 1883. 70 p. 8°.

Mawley, E. The weather of 1882 as observed in the neighborhood of London, and compared in all respects with that of an average year. London, *Stanford*, 1883. 75 p. 8°.

Morgan, C. L. Water: its teachings in chemistry, physics and physiography. London, *Stanford*, 1883. 12°.

Perre de Roo, La, V. Monographie des pigeons domestiques. Paris, 1833. 394 p., illustr. 8°.

Perrier, E. Éléments de zoologie pour la classe de cinquième. Paris, *Hachette*, 1883. 12+497 p., illustr. 12°.

Peters, C. H. F. Celestial charts made at the Litchfield observatory of Hamilton college. Nos. 1-20. Clinton, 1883. Imp. f°.

Renault, B. Cours de botanique fossile fait au Muséum d'histoire naturelle. 3 ann. Paris, *Masson*, 1883. 322 p., 36 pl. 8°.

Reuter, O. M. Finlands och den Skandinaviska halföns Hemiptera Heteroptera. Stockholm, 1882. 8°.

Scheube, B. Die Ainos. Yokohama, 1883. 32 p., illustr. f°.

Schwackhöfer, F. Technologie der wärme u. des wassers mit besonderer berüksichtigung des dampfkesselbetriebes. Wien, 1883. Illustr. 8°.

Sedgwick, W. Light the dominant force of the universe: showing by means of experiments, what light is, what electricity is, and what life is; also, how to reconcile religion and science. London, 1883. 298 p. 8°.

Sicard, H. Éléments de zoologie. Paris, *Baillière*, 1883. 16+842 p., illustr. 8°.

Stoddard, John T. An outline of qualitative analysis for beginners. Northampton, *Gazette printing-office*, 1883. 4+54 p. 16°.

Thomas, Albert. Manuel de l'alcœométrie. Tables et formules pour servir au calcul des mélanges d'eaux-de-vie à tous les degrés. Lille, *Michelet*, 1882. 8°.

United States coast and geodetic survey. A treatise on projections by Thomas Craig. Washington, *Government*, 1882. 14+247 p. 4°.

United States—Department of agriculture. Division of entomology. Bulletin. Nos. 1, 2. Washington, *Government*, 1883. 62, 36 p. 8°.

Urbanitzky, A. v. Das elektrische licht und die hierzu angewendeten lampen, kohlen u. beleuchtungskörper. Wien, 1883. 240 p., illustr. 8°.

Vambery, H. Der ursprung der Magyaren. Eine ethnologische studie. Leipzig, 1882. 599 p. 8°.

Woodward, C. M. Manual education a feature in public education. (A paper read before The national teachers' association, Saratoga, July 13, 1882.) Boston, *The Prang educational company*, 1883. 19 p. 8°.

Zaborowski, S. Nouvelles et curiosités scientifiques. Paris, *Marpon & Flammarion*, 1883. 525 p. 18°.

Zopf, W. Die spaltpilze. Breslau, 1883. 144 p., illustr. 8°.